119-1923

FISHERIES—ENGLAND & WALES

MINISTRY OF AGRICULTURE AND FISHERIES

REPORT ON
SEA FISHERIES

FOR THE YEARS

1919, 1920, 1921, 1922 AND 1923

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.
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Ministry of Agriculture and Fisheries,
Fisheries Department,
43, Parliament Street, London, S.W.1,

December, 1924.

To the Minister of Agriculture and Fisheries.

Sir,

I have the honour to submit a Report on Sea Fisheries for the years 1919-1923. The Report was originally completed more than a year ago as a Report for the years 1919-1922, but circumstances over which this Department had, unhappily, no control so delayed its publication that it has been thought better to add the Report for 1923, and thus to prepare the way for the resumption of the practice of publishing Annual Reports.

The last Report on Sea Fisheries carried the history of the Fisheries up to the end of the war; the present one refers to what we hope may be described as the period of recovery from the exhaustion of war. Recovery is certainly not yet complete, but at the time when this letter is written the signs are not wholly discouraging, and, to use the homely phraseology of the fisherman, we think we begin to feel " the lift of the tide." The period to which the Report refers, like the war period, is one of abnormal circumstances, the effect of which can best be appreciated when the happenings of the period are considered as a whole. It was the recognition of this fact, more than any other consideration, which governed the decision to publish another Report covering a group of years. The production of such a Report is a far more difficult matter than the routine production of Annual Reports, and the simpler, which is also, in normal circumstances, the more convenient practice, will now be resumed. The Report for the year 1924 will be ready for publication, so far as this Department is concerned, in the spring or early summer of next year.

This Report follows in general the lines of previous Reports, but one innovation has been introduced which it is hoped may be of practical value. In connection with the various chapters of the Report which deal with departmental activities involving the expenditure of public money, simple financial statements are presented so that readers may see for themselves what these activities have cost, and may form their own judgment as to whether the money has been well and reasonably spent. These accounts will, it is thought, be welcomed by those who take a critical interest in the work of the Department and are not unfrequently misled

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by the somewhat intricate form of published estimates and appropriation accounts. We have endeavoured to take our critics quite frankly into our confidence. No endeavour has been made to cover up mistakes; he who never made a mistake never made anything. As to what is or is not a mistake there will, of course, be differences of opinion. Our endeavour has been to present faithfully the facts upon which an opinion can be formed.

I am,

Sir,

Your obedient Servant,

HENRY G. MAURICE,
Fisheries Secretary.

INTRODUCTION.

Demobilisation.

The last Report carried the history of the Fisheries up to the stage at which the transition from war to peace conditions had already begun. The experience, not only of this country, but of the world, has shown how hard and how slow is the process of full recovery. In what may be called the demobilisation period, however, progress was rapid, and hopes were raised most of which were doomed to disappointment. The tasks, many and urgent, on which the Fisheries Department was then engaged were at the time of absorbing interest to those immediately concerned, but the narrative of them now in any detail would be bald and unprofitable. It was a period of hard but cheerful and hopeful work. The main thing was to get back as quickly as possible to something like normal fishing, and the questions which claimed first attention were the demobilisation of fishermen and shore workers connected with the fishing industry, the release of fishing vessels, and the removal, so far as possible, of restrictions of the movements of fishermen at sea. A brief account was given in the last Report of the process of demobilisation. With the help of the Departments concerned, particularly the Ministry of Labour and the Admiralty, every endeavour was made to secure that demobilisation should be so conducted that the release of fishing vessels, of fishermen and of shore workers might keep pace with one another, so that ships might be available for the men as they were released, and shore staffs could be increased to deal with the increased traffic in fish. It was necessary to retain a certain number of men for mine-sweeping operations, but for the most part these were volunteers. By the end of June, 1919, more than 1,400 vessels belonging to ports in England and Wales had been sent to be dismantled of their war equipment and refitted for fishing purposes. Some of them were taken over by the owners as soon as their war equipment had been taken off them, to be reconditioned by themselves as opportunity served, agreed sums being paid by the Admiralty in lieu of actual performance of the work. In practice—and this was the main concern of the Ministry—the demobilised fishermen were seldom kept waiting long for employment on fishing vessels. There were inevitable delays in the reconditioning of ships, but employment was found for a considerable number of men by the arrangements for the use of Admiralty ships referred to on page ix below.

Removal of Restrictions.

The movements of fishing vessels had been restricted during the war to protect them from obvious dangers. One danger persisted after the Armistice, and continues to some slight extent even to this day, namely, the danger from mines. There were also restrictions on landing and lighting which formed part of the scheme of defence of the ports. These restrictions were removed at a very early date, and the area within which fishing was allowed was extended. Early in the year 1919 the system of permits for fishing vessels—which was fully explained in the last Report—was abolished, and there were substituted for them Naval directions issued through the Ministry. Finally, on the 30th August, 1919, the Admiralty gave permission for fishing in all waters except those described as dangerous in the current issue of "Notices to Mariners." In the meantime, every endeavour was being made by the Admiralty to clear the minefields, and a special effort was made to remove as quickly as possible those which interfered with the normal course of the herring fishing. Rifles and ammunition were issued to selected skippers to enable them to sink by gun fire floating mines which were a serious source of danger. Skippers were also furnished with sets of special tools to enable them to put out of action mines which might be brought up in their nets. With each set of tools instructions as to how to use them were issued and a Naval Officer visited the principal fishing ports and gave demonstrations of their use. How serious was the danger from mines will be seen from the fact that in the year 1919, 19 fishing vessels were sunk by mines and 18 were damaged, 150 lives in all being lost; and, in 1920, 12 vessels and 101 lives were lost, or presumed to have been lost, through this cause. Sometimes there was no doubt as to the fate of these ships, sometimes an explosion was heard in the direction where a fishing vessel was known to be, and other vessels hurrying to the spot found only wreckage from which but one conclusion could be drawn; sometimes a vessel sailed from port and was simply never heard of again. For the fishermen the end of war did not bring about a complete end of war risks.

Coal.

The rapid resumption of fishing operations, leading to a great increase in the landings of fish, naturally gave rise to a host of new problems. There was much discussion about the lamentable control of fish prices, which was not entirely abolished till May, 1920. More coal was required for the greater number of vessels fishing, and not only the supply but also the price of coal, both of which were controlled, became questions of moment. Both during and after the war the Fishing Industry and the Fisheries Department were met in a sympathetic spirit by the Coal Mines Department of the Board of Trade and by the Coal Controller as regards the provision of supplies. The high price of coal is even now the chief hindrance to the prosperity of the Fishing Industry. During the war those who were fortunate enough to have vessels free to fish cared little what price they paid, because they were getting good prices for their fish, but, with the increase of fishing, the price of fish fell and the price of coal did not fall, but tended to increase. The Fishing Industry had consistently contended that trawlers should be regarded as factories under the Price of Coal (Limitation) Act, 1915, and thus obtain the benefit of the lower price charged to productive industries. There was great force in their argument, for, obviously, a fishing vessel is primarily a producer and only incidentally a carrier, and it must be remembered that the owner of a fishing vessel cannot raise the price of his product to cover increased costs. Although the contention of the Fishing Industry was not fully accepted, either in principle or in practice, the prices chargeable to fishing vessels for bunker coal were ultimately made to approximate very closely to the prices of industrial coal for home industries. During the war period and subsequently, when difficulties arose from strikes and threats of strikes, the Fishing Industry was treated with sympathy by the Coal Mines Department, but, should the occasion ever again arise to enforce statutory regulations for coal prices, with regard to the comparative importance of the purpose for which coal is required, it is to be hoped that the position of the steam fishing vessel as in fact a productive machine will receive full recognition.

Transport.

As the advocate of the Fishing Industry, the Department was called upon to take an active part in discussions of the question of railway facilities for the transport of fish. The railways were suddenly called upon, with reduced rolling stock, to carry a much greater volume of goods, and transport difficulties and delays occurred, which fell with especial force upon the Fishing Industry because of the perishable nature of the commodity it produces. Although complaints are still to be heard about the freight charges for fish, other troubles have in the main been remedied, and the only outstanding grievance at the moment is the requirement of the Railway Companies, initiated during the war and then supposed to be a war measure, that the carriage on consignments of fish should be prepaid. This requirement prejudicially affects wholesale fish merchants who despatch fish to the inland markets for sale on commission, and there is reason to think that, as a result of it, Billingsgate and other large markets are not unfrequently deprived of supplies they could absorb, and waste occurs at the ports.

Wrecks.

Complaints were received from many of the fishing ports of damage done to fishing gear and of other difficulties which fishermen encountered owing to numerous wrecks distributed around the coasts. This question is briefly dealt with in Chapter IX. There is no hope of a complete solution of the difficulty, and the most that could be expected was that a limited number of the most serious obstructions might be dealt with either by removal or by buoying. It has been suggested, and there may be something in the suggestion, that some good may come out of this evil. Trawling operations can only be carried out with extreme risk of loss of gear in proximity to wrecks; such areas may, therefore, provide sanctuaries for fish from which other areas may be replenished.

Reparations.

Another problem arising out of the war which engaged the attention of the Department was the question of reparations. The handling of it provides an illustration—one of many—of the difficulty of reaching a wise and far-seeing conclusion in dealing with a very complex question in uncertain conditions. Representatives of the Fishing Industry strongly pressed the Ministry to secure for them reparation in the form of German shipping tonnage on the basis of ton for ton of British tonnage of a similar character destroyed by the enemy. The Department pressed the point, and eventually, as a part of the Peace Treaty, it was decided that a limited quantity of German trawler tonnage should be handed over directly, and that a further quantity should be built later, to the requirements of H.M. Government. The quantities provided for represented something less than 10 per cent. of the total tonnage destroyed, but it proved to be more than the industry could absorb. Indeed, the industry was regarding with great concern the disposal of the large number of fishing vessels constructed by the Admiralty and placed on the market by that Department. Consequently the Ministry found itself severely criticised by the very persons who had pressed for ton for ton reparation for the part that it played in arranging that a limited number of German trawlers should be brought to this country and disposed of here.

The whole position with regard to fishing tonnage in the years immediately succeeding the war is complicated in the extreme. To begin with, restrictions had been placed on the sale abroad of any fishing vessel. These restrictions were, at the request of the industry, gradually relaxed, and finally removed. The proposal to dispose of Admiralty trawlers and drifters in this country was viewed with alarm, because it was feared that an excessive number of such ships on the market would disorganise the industry and depreciate values. On the other hand, the disposal of such vessels abroad was deprecated because it would tend to accentuate the competition of foreign with British vessels on the fishing grounds. Although many fishing companies—but more especially newly-formed ones which purchased vessels at extravagant prices during the boom which followed the war—have been hardly hit by the rapid depreciation of the value of fishing vessels, the fact that at the time when this Report is written Admiralty fishing vessels are still finding a market and new trawlers are being built suggests that something approaching a state of equilibrium has been reached in the industry as a whole as between the tonnage available and that which can be economically employed.

Proposed Co-operative Fishing Company.

At the conclusion of the war the Admiralty had upon their hands a large number of trawlers and drifters built for minesweeping and other Naval purposes, and proposed to hand them over to a co-operative fishing company to be composed of fishermen. The purpose of the scheme was to recognise the valuable services of the fishermen in the war by giving them the opportunity of becoming joint owners of the Government ships. Ultimately, this project fell through, owing to lack of support on the part of the fishermen, and was finally abandoned early in 1921. Towards the end of 1919 there were lying at various bases a number of trawlers destined for this Co-operative Company, and, in order to utilise them pending the formation of the company, and in order also to provide employment for fishermen who had been demobilised whilst their vessels were being reconditioned, it was arranged by the Admiralty and the Ministry that the latter should work these vessels both as carriers and in fishing on Admiralty account. There was at that time a great shortage of small craft suitable for the short trades and coast-wise voyages, and a number of the trawlers, amounting ultimately to 39, and four drifters, were employed in carrying cargoes of fresh and pickled herring to the Continent and bringing back timber and other material for which there was a large demand in this country at the time. Although these operations were not profitable in themselves, they certainly were the means of clearing both the pickled and fresh herrings from this country and so relieving the obligations of the Government under the guarantee given to the herring fishermen (see Chapter III). The carrying scheme came to an end in August, 1920.

The fishing operations were carried on from December, 1919, until March, 1921. In all, 45 trawlers were employed, and were distributed amongst the various fishing ports, and 18 drifters were worked from Lowestoft. It was intended that these vessels should be handed over as going concerns, complete with gear and equipment, to the Co-operative Company. When the project to form this company was finally abandoned, the vessels had to be laid up and their gear disposed of for what it would fetch, and, consequently, a considerable loss was incurred. Owing mainly to causes which affected all or most industries the fishing operations themselves were not profitable. Against the loss which was sustained must be set off the saving in unemployment donation to which the ex-Service crews would have been entitled, if unemployed, as well as the amount saved in respect of care and maintenance which would have been involved had the vessels been laid up, and also the deterioration which they would have suffered if not used. The use of the vessels also served to dispel doubts which had been raised in many quarters as to their efficiency for fishing purposes, and, no doubt, enabled the Admiralty to get larger prices for them when they were sold.

Disposal of Admiralty Drifters.

In addition to the trawlers, the Admiralty had on their hands a large number of drifters, some of which were constructed of steel and others of wood. In October, 1919, the Cabinet decided that all surplus drifters belonging to the Admiralty should be handed over, after they had been reconditioned and adapted for fishing operations, to the Fishery Board for Scotland and the Ministry of Agriculture and Fisheries for disposal to ex-Service fishermen on terms allowing the purchase price to be paid by instalments. The motive of this decision was the same as that which prompted the proposal to form a Co-operative Trawling Company. So far as England and Wales are concerned, the venture has not been a happy one, the greater number of the fishermen having found it impossible, under the conditions of extreme depression which followed the boom period of 1919 and 1920, to pay their way and meet their obligations.

Disabilities of Inshore Fishermen.

Serious difficulties confronted many of the inshore fishermen returning from Naval or Military service. During their absence their boats and gear had suffered from lack of attention, and in many cases they could not recommence fishing without financial assistance. Their case was different from that of most industries, because their gear depends for its efficiency upon constant attention, whether in use or not; and such attention could not, as a rule, be provided in their absence. To meet such cases the Ministry was able to secure from the Military Service (Civil Liabilities) Department grants amounting in all to some £6,000. There were, however, a number of men whose difficulties did not arise from actual military service, and who did not, therefore, come within the scope of the grants at the disposal of the Military Service (Civil Liabilities) Department. Gear was frequently lost through war operations—lobster-pots swept up by minesweepers, nets fouled by sunken wrecks—and cases were brought to the notice of the Ministry in which the bare livelihood of small inshore fishermen was threatened by such accidents. The Department, accordingly, appealed for assistance to the National Relief Fund. A sum of £5,000 was placed at its disposal, and by this means it was able to give essential help to a number of fishermen who, usually from age or infirmity, had not been enrolled in the fighting forces.

The Department's Outdoor Staff.

The above, briefly enumerated, are some of the principal problems arising directly out of the war which engaged the attention of the Department. It was greatly assisted in dealing with these problems in their local aspects by its Outdoor Staff, distributed at convenient points on the coast. The need for such a staff had been felt before the war; the war rendered the provision of it imperative; at so many points were the Naval Authorities and the Fishing Industry in contact, and so many questions had to be dealt with promptly which absolutely required discussion on the spot. The staff employed by the Ministry during the war was necessarily of a more or less makeshift character, and to a great extent the Ministry had recourse to voluntary services, which were acknowledged in the last Report.

As a result of the experience of the war, it was decided to continue the system of having local officers for sea fishery work, and subsequently for salmon and freshwater fisheries. It was, of course, no longer necessary to distribute the officers, as hitherto, in relation to the districts of the Naval Commands, and, instead, their stations were chosen with regard to the comparative local importance of the fisheries and general convenience of administration.

The staff consists of 20 officers, four of whom are stationed in London and the remainder distributed among ten districts into which England and Wales is for this purpose divided. A list of these Districts, with the addresses of their Headquarters, is printed on page 151.

It is not possible to give a strict definition of the duties of the Coastal Staff, but, generally speaking, its members are to act as the representatives and, within the scope of their authority, the agents of the Ministry for all fishery purposes within their respective districts. They have to acquaint themselves with everything in connection with the modes of fishing practised in their districts, the markets to which the fish caught is sent and the means by which it is distributed, and the sources from which fishing materials are derived. They are expected so far as possible to become personally acquainted with and to get into touch with all persons interested in fishing in their districts, and they must be prepared to undertake within their districts any duties in connection with fisheries which may be required. They must also, of course, keep the Ministry fully informed of all that goes on in their districts in connection with fisheries.

Since their establishment, they have been called upon to deal with three national strikes, *i.e.*, the railway strike of September, 1919, and the coal strikes of 1920 and 1921; and, in connection with these crises, they had to undertake the emergency transport of fish, the rationing of coal and other emergency arrangements rendered necessary by the abnormal state of affairs. They have also had to deal with measures of reconstruction, *e.g.*, the administration of grants in connection with the Military Service (Civil Liabilities) Scheme, the supply of Admiralty drifters to ex-Service fishermen, and loans for the provision of motors. In addition, they have been successful in settling disputes between fishing vessel owners and their men, and so preventing strikes, and are very frequently employed in getting over the difficulties which the fishermen experience both in obtaining supplies and in the transport of their fish to the markets.

The service is for the most part recruited from men who have served in some branch of the Naval Service during the war. Such men are peculiarly suitable, both on account of their knowledge of the sea and the experience they have had in dealing with seafaring men. The new system has been in force long enough to show that it will be of great assistance to the Fisheries Department in carrying out its work of developing and maintaining the fisheries.

Review of the Five Years' Fishing (*Chapter I*).

With the opening of the year 1919 a return was made to the pre-war scale of collection and tabulation of fishing statistics; but in order that the results might be available to the public at the earliest possible date, a change in the method of publication of the Report was instituted. Instead of the Tables forming Part II of the Report as had hitherto been the custom, they were issued as a separate publication with the title of "Sea Fisheries Statistical Tables." The Tables for the two years 1919-20 were issued in one volume in June 1921, those for 1921 in July 1922, for 1922 in May 1923, and for 1923 in June 1924.

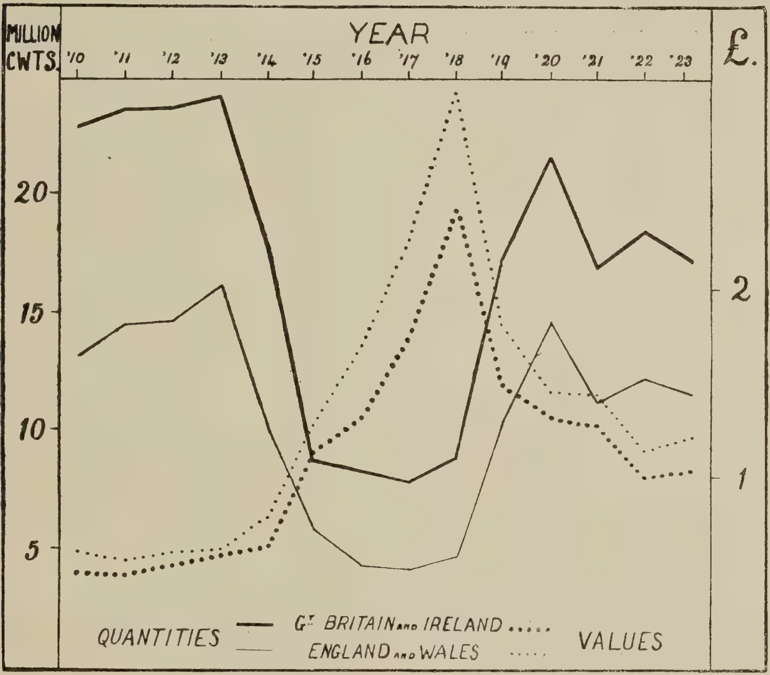
In 1919 some alteration of the Tables was introduced, mainly with a view to economy of space, but it is believed that no important information of a general character has been omitted. The principal deletions were the Tables dealing with the catches of the individual kinds of demersal fish from the North Sea areas: those showing the particulars of the distribution and catch per day's absence of individual kinds of fish in the regions (the distribution can still be obtained from Table 4 of the new series); and those dealing with the statistics of foreign countries. (The *Bulletin Statistique*, issued by the "International Council for the Exploration of the Sea," deals with the statistics of North-Western Europe in a comprehensive manner and at considerable length.) Some new serial Tables dealing with the fluctuations of quantities, and the method and locality of capture over a period of years, were inserted, and in 1923 a new Table showing for the more important fish the regional distribution and average catch per day's absence for steam trawlers and liners since 1906 was introduced.

During the period under review, an important alteration has been made in the sub-division of the North Sea into smaller units for purposes of tabulation of the statistics; the catches of first-class vessels are now tabulated in units of half a degree of latitude by one degree of longitude in place of the irregular areas, based upon depth, which were used previously. So successful for purposes of scientific investigation has this proved to be, that the method has been extended to embrace all the fishing regions.

A further modification of method has also recently been introduced with a view to obtaining a closer relation between the catch of demersal fish and fishing power expended. This necessitated a knowledge of the number of hours that fishing had actually been proceeding during each voyage. Some difficulty has been experienced in obtaining this information, but from the records obtained, it has been possible to work out the average catch, for a standard 100 hours of actual fishing, for each region fished by steam, motor and sailing trawlers, and for vessels using the Danish Seine, and this was shown for the first time in Table VI of the Statistical Tables for 1922. These figures should give a much better indication of the density of fish on the grounds because they eliminate one of the chief disturbing factors of the catch per day's absence, *i.e.*, the time occupied in travelling to and from the selected fishing grounds; and from them it will be seen that, taking the North Sea density as = 100, the Barents Sea shows a density of 1,299 and 961, Iceland 780 and 804, South of Ireland 179 and 211, Faroe 516 and 467, West of Scotland 239 and 262, English Channel 91 and 99, and the Irish Sea 86 and 103 in the years 1922 and 1923 respectively for steam trawler catches. The method has also been applied to the small rectangular divisions of the regions, but for reasons of economy the results cannot be published.

The general course of the landings during the five years under review will be seen from the accompanying Figure I. During 1919 and 1920 the quantities landed rose almost as rapidly as they had fallen in the early days of the war, but the collapse of the European cured herring market, coupled with bad herring seasons, the coal strike of 1921, and, the rapid diminution of the extra stock of demersal fish accumulated on the grounds during the war resulted in a great fall in 1921 which was only to a very limited extent recovered in 1922. The year 1923 saw a further slight fall.

FIG. I.—The quantity and average value per cwt. landed by British fishing vessels 1910-1923.

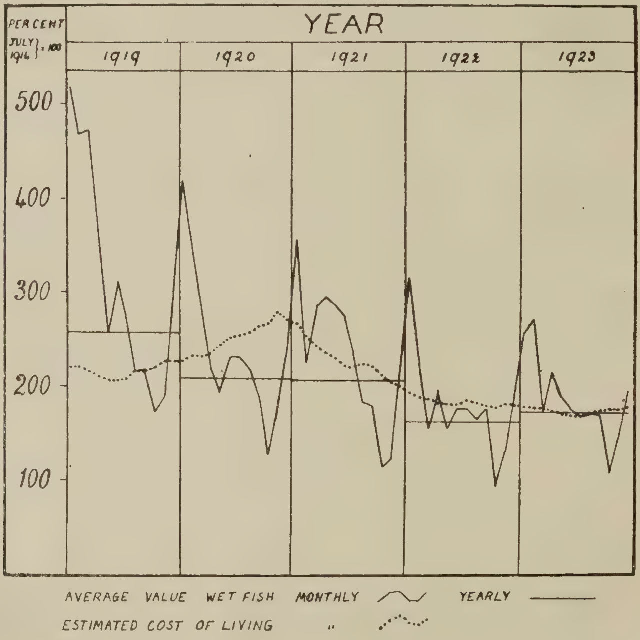


By the end of 1919 the trawling and lining fleets were, as regards catching power, back to pre-war efficiency, and it is of interest to note that, as regards the English and Welsh landings of demersal fish (mainly the product of these fleets) an absolute record was reached in 1920 with a total of 9½ million cwts., which exceeded the previous highest figure by half a million cwts. In 1921 the quantity fell to under 8 million, rising in 1922 to 9 million only to fall again to a little over 8 million cwts. in 1923.

The average value of wet fish per cwt. fell continuously from 1918 to 1922, but, whereas 1919, 1920 and 1922 showed considerable decreases, 1921, with its diminished quantities, showed but a very little fall. There was a slight rise in 1923, and the average value at first sale of wet fish was over 2d. per lb. for the whole of Great Britain; for England and Wales alone it was just over 2½d. per lb.

There is every reason to believe that before the war a fairly close economic connection had been established between landings and average values, the latter being sufficient to allow for cost of production and to leave a fair margin of profit; in Figure II the monthly and annual variations in average value of wet fish in England and Wales for the years 1919-23, as compared with July 1914 (= 100) are contrasted with the Board of Trade figures of the variations in the cost of maintaining the pre-war standard of living amongst the working classes.

FIG. II.—The percentage variation in the monthly and annual average value of wet fish landed in England and Wales 1919-1923 compared with the monthly variation in the cost of living.

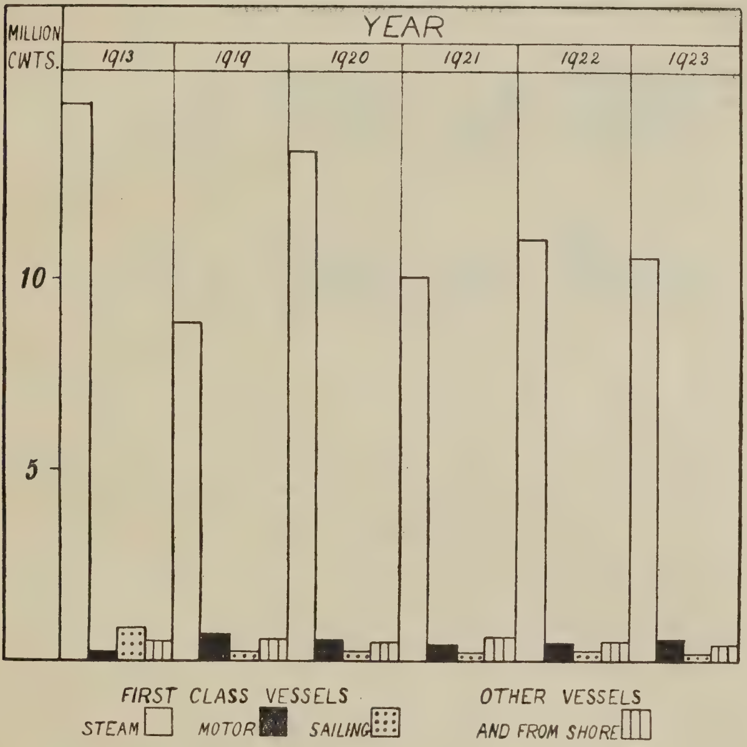


During the war the index figure of the value of fish increased at a much greater rate than that of the cost of living, but as will be seen from the diagram, in 1919 it fell rapidly, and in 1920 it was actually below for the greater part of the year; in the last three years although the fish price indices were generally below those of the cost of living, the differences were not so marked, and there was a distinct tendency for them to lie closer together. Assuming that the cost of living figures are indicative of the cost of fish production, the return to normal output which took place during 1919 resulted in prices approaching towards the cost of fish production; but apparently in 1920 production overtook demand, and the prices realised fell below the margin at which business could be carried on profitably. The fall in the general cost of living which began at the end of 1920 and was rapid during 1921 brought the cost of living indices down much nearer those for fish prices;

but during 1922, although the production figures continued to fall, there was a corresponding decline in the fish prices, and they still remained in relatively the same position as in 1921. The slight rise in values in 1923 coupled with the slight fall in the cost of living indices has brought the two factors again into very close relationship with each other.

The relative importance of the types of vessels used is illustrated in Figure III.

Fig. III.—The quantity of wet fish landed in England and Wales by each kind of 1st Class fishing vessel and by all other means of sea fishing in 1913 and 1919-1923.

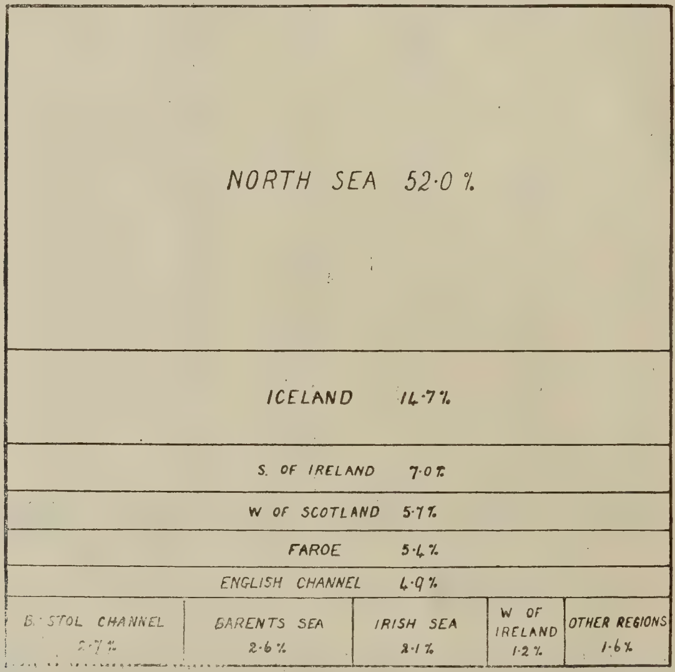


During 1919 and 1920 the landings by steamers rapidly increased, the 1920 total of over 13 million cwts. being second only to the record year 1913. In 1921 there was a big fall to only ten million cwts. followed by a moderate recovery in 1922, and a slight decline in 1923. Proportionately about 90 per cent. of the total is landed by steam vessels. First-class motor vessels in 1919 accounted for 640,000 cwts., or 6 per cent. of the total, which constitutes the record catch for this type of vessel. Since that year the catches have been smaller, but there has been continuous increase since 1921. The landings by first-class sailing vessels have steadily decreased from about a quarter of a million cwts. in 1919 (a total which is only one third of the 1913 figure) to only 170,000 cwts. in 1923; as an instrument of fishing the big sailing vessel is still losing ground. The whole of the first-class fleets accounted for about 95 per cent. of the total landings of wet fish, leaving some 5 per cent. or approximately half a million cwts. as the contribution by smaller vessels and fishing from the shore.

A feature of the period under review has been the growth of the use of the Danish Seine as an instrument of capture. Both steam and motor vessels have adopted this net, but, whilst the steamers have continuously increased their catches to nearly half a million cwts. in 1923, the motors landed 12,000 cwts. in 1922 and fell off to only 8,000 cwts. in 1923.

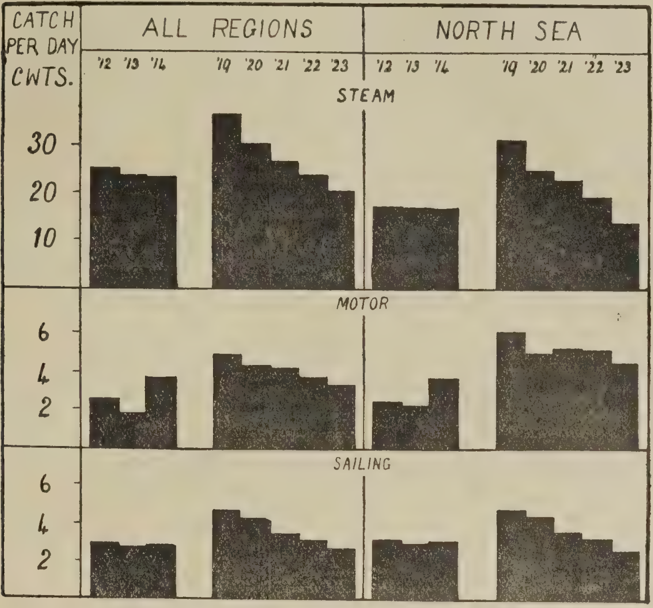
A point of some interest is the relative proportions of the total catch yielded by the different fishing regions, and in Figure IV an indication of this is given for the year 1923.

Fig. IV.—The relative proportions of wet fish landed from the principal regions by British fishing vessels in 1923.



The outline square is equivalent to the total landings of wet fish, the rectangles being the proportionate quantities from each region which contributed appreciable amounts. The North Sea accounted for over half of the gross total, the principal fish being herrings which formed nearly one half of the catch and haddock which formed over a quarter. Iceland came next with about one-seventh of the total, one-half being cod and about one-fifth haddock. Then followed the South of Ireland with about one-fourteenth of the total, about two-fifths being hake. None of the remaining regions accounted for as much as 6 per cent. of the total,

FIG. V.—Average catch per day's absence by trawlers for all regions and for the North Sea 1912-1914 and 1919-1923.



In Figure V the trend of the catch per day's absence from port is illustrated for all regions combined and for the North Sea alone, and it will be seen that the average catch showed a very material increase in 1919 over earlier years, but in 1920 and later years there was a progressive decline till in 1923 the yield was actually below that of 1913 for both steam and sailing trawlers: the rapidity with which the average catch has fallen to below the pre-war standard is remarkable. Motor trawlers, whilst exhibiting a general decline since 1919, have not fallen to pre-war standard, but it must be remembered that, prior to the war, their numbers were very few, and the standard fixed upon their returns therefore does not form a good basis for comparison.

Fishing Vessels and Men (Chapter II).

Since the publication of the last Report on Sea Fisheries,* details of the loss of life and of ships from 1st July, 1914, to end of 1918, have become available. No less than 1,586 fishermen lost their lives whilst engaged in fishing, 1,127 of these deaths resulting from acts of war. These figures are exclusive of the loss of life amongst ex-fishermen on active service. From 1919 to 1922 (the latest year available) the deaths amongst crews of fishing vessels amounted to 73, 122, 112 and 94 respectively: the annual average over the five years preceding the war was 267.

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* *Fisheries in the Great War*, being the Report on Sea Fisheries for the years 1915 to 1918. (For particulars see cover.)

The gross total of fishing vessels sunk during the war period was 1,186 but, of these, 400 were sunk whilst on war service. The other 786 were non-combatant, and of these 675 were sunk by enemy action and the remaining 111 lost by ordinary casualty.

From 1919 to 1922 the numbers lost were 38, 88, 71 and 63 respectively, against an average of 101 for the five pre-war years, but in addition there were 83, 110, 76 and 60 casualties to vessels described as serious, the pre-war average being 349.

The heavy drain on the industry during the war, owing to the withdrawal of fishing vessels for war service, was materially lessened during 1919; by the end of that year only 205 had not been returned to fishing, and by the end of 1920 practically all had been returned to their normal occupation.

The total number of first class Steam Vessels on the register reached a maximum in 1920 with 2,147 but fell slightly each subsequent year to 2,032 in 1923. First class Motor Vessels steadily increased up to 1921 when the total—471—showed an addition of 163 in five years, but the rate of increase fell from 50 in 1919 and 34 in 1920 to only five in 1921. In 1922 there was a fall of three in the numbers and in 1923 a further decline of 14, leaving a total of 454. The first class Sailing Vessels continued to disappear, only 489 being on the register at the end of 1923 as against 1,936 in 1907 when they reached their maximum number. Amongst the second class vessels there has been a very rapid increase of motors from 126 in 1912 to 1,921 in 1922; but the sailing vessels have fallen during the same period from 3,792 to 2,176. Second class steamers are very few in numbers, there being only 13 registered for 1922, the latest year available.

The number of men and boys employed in sea fishing had also nearly regained its pre-war magnitude by the end of 1919, the total for England and Wales being 42,555, which is less than five per cent. below the total for 1914. In 1920, however, the number fell to 41,117, followed by decreases in 1921 to 38,577 and 1922 to 37,552; there was a slight recovery in 1923 to 38,145.

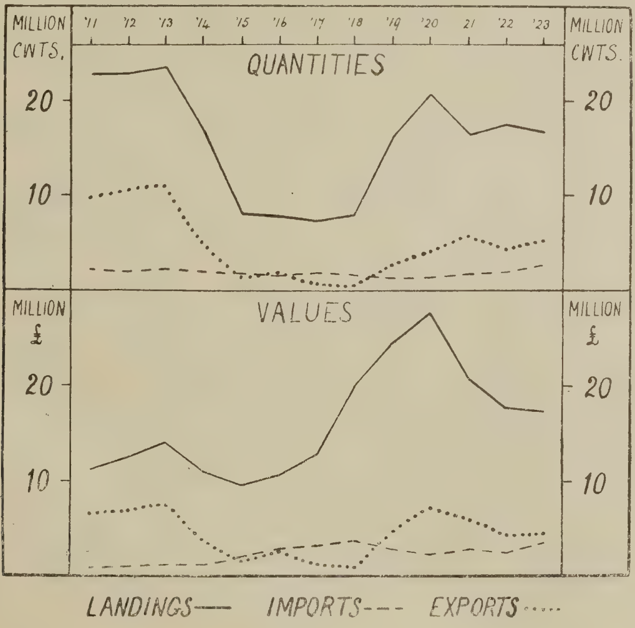
Foreign Trade.

Foreign Trade has made only a slow recovery from the dislocation caused by the war. Imports fell to their lowest level in 1920 with 2¾ million cwts. as against 3½ million cwts. pre-war; they slightly recovered the two subsequent years but in 1923 they increased by ¾ million cwts. to a total of over 3¾ million cwts., the bulk of the increase being in fresh fish—cod, haddock, plaice and other demersal fish—from foreign fishing vessels and from Denmark and Holland, and herrings from Norway.

Exports have fluctuated more rapidly than imports, but at their highest, in 1921, they only totalled a little more than half the pre-war figure and in 1922 they fell to about two-fifths, rising again in 1923 to nearly one-half. The change in money values has been reflected in the trade returns, and in consequence comparison from year to year is not very illuminating. Since 1919 we have exported more fish than we have imported, but the balance of value remains, as it has been since 1914, an adverse one: this is due to the fact that generally speaking the fish exported, chiefly herrings, has a much lower value per cwt. than the salmon which forms a considerable portion of the fish imported.*

An attempt has been made in the next diagram to show the importance of the imports and exports of fish in comparison with the British landings, and for this purpose the imports re-exported and also the imports of canned fish have been deducted from the gross imports. The imports and exports figures relate to the United Kingdom, but as the Irish share is negligible they may be considered for all intents and purposes as directly comparable with the figures for wet fish of British taking which relate only to Great Britain.

FIG. VI.—Quantity and value of British-caught fish landed in Great Britain, with the corresponding exports of British fish and the imports, other than canned, retained in the country 1911-1923.



The line for the exports roughly follows the general shape of that for landings, but whereas before the war exports approximately equalled two-fifths of the landings, the proportion fell to less than one-twentieth in 1918 rising in later years to one-fifth in 1920 and to over one-third in 1921, falling to about one quarter in 1922, and rising again to one-third in 1923. A remarkable feature of the figure is the steadiness of imports retained which included all fish landed by foreign fishing vessels as well as that brought in by cargo boats. From its highest point in 1923 to the lowest in 1919 the difference was about one-third of the maximum which occurred in 1923 and was very slightly above the previous highest which occurred in 1918. The values show very similar movements to the quantities but the disturbing influence of the change in money values detracts from their use for comparative purposes.

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* It is hoped that it will be possible in the Report for 1924 to deal in some detail with the question of foreign markets for fish.

It might reasonably be assumed that in view of the difficulty of exporting our surplus fish, the home market might be expanded to absorb a larger proportion of the landings, especially when it is realised that our average consumption per head of the population is very low. To illustrate just how low this is, a series of calculations has been made of the amount of wet fish consumed in the United Kingdom back to 1907, by deducting the exports from the total of the British landings and the imports retained. When divided by the estimated population these totals give average figures per head of fish consumed, but they also include the wastage which, however, may be assumed to be a tolerably constant proportion. They vary between 36 and 42 lbs. per head except during the war years and in 1920 and 1921. During the war consumption necessarily fell off because of the limited amount that was available, but the variation from 48 lbs. in 1920 to 32 lbs. in 1921 is due to the large quantities of herring which were caught and cured in 1920 but not exported until 1921; taking the two years together the average consumption is normal at 40 lbs. To minimise the error introduced by the variation in the stock carried over from one year to the next, the period has been divided into four-yearly groups, and for these the average yearly consumption per head of the population worked out as follows :— 1907-1910—41¼ lbs. 1911-1914—39½ lbs. 1915-1918—27¼ lbs. and 1919-1922—40 lbs: the group 1920-1923 gave an average of less than 38¾ lbs. per head. These figures do not show any tendency towards any increase in the quantity of fish in the national diet since 1907 : rather they tend to prove a decrease which has been accentuated during the last few years. It is clear that fish as presented to the consumer is not sufficiently attractive to be given a permanent position as a principal item in the menu; and that if the home market is to expand, it is essential to educate the consumers to the dietetic value of good fresh fish, and at the same time ensure that supplies of such fish, at prices which will enable it to compete with all classes of meat, are continuously available.

The Herring Fishery (*Chapter III*).

During the war the herring fishery dwindled to comparatively insignificant dimensions, and the autumn herring fishery, in particular, was either wholly interrupted or, in the later years of the war, prosecuted by a strictly limited number of local vessels. The herring fishermen meanwhile, as they fought unequal fights with the Austrian cruisers in the Mediterranean, did the "donkey" work of the Dover patrol, dodged and fought submarines on other patrol routes, and, on occasions, went down fighting, flag flying, and the one gun served to the last man and the last minute, were always looking forward to the good time to come when they would once more ship their nets and garner that harvest of the sea, for which, by all accounts, a starving world was waiting. And so, when peace came, and with it the smooth and rapid demobilisation of the Auxiliary Patrol, the men came back full of high hopes, not of an idle holiday, but of strenuous work leading to fortune. These hopes were soon to be dashed, for, before the Scottish summer fishing began, it became clear not only that the cost of everything used in the fishing had risen to almost prohibitive heights and the general cost of living was such as to dwarf previous earnings of fishermen to insignificance, but also that as a result of the dislocation of the finances of Europe, and especially of Germany and Russia, the two principal markets for pickled herrings, there was a very grave doubt whether the product of the fishery could be sold when it had been caught.

The economics of the herring fishery can never be properly understood unless certain peculiar features of the industry are clearly realised. The fishery is seasonal, it depends upon the migrations of shoals of herrings which must be taken as opportunity serves; there may be poor fishing for many nights, and then suddenly the shoals may be struck and every ship come in with many tons of herrings on board. The home market for fresh herrings, kippers, bloaters, and the like can absorb only a limited proportion of the catch; the rest must be preserved or wasted. The method of preservation hitherto adopted, from which the industry has been built up, is pickling in brine. The process must be commenced immediately, while the herrings are fresh. This enormous bulk of herrings, which may be as much as or even more than 10,000 tons, distributed between the ports of Lowestoft and Yarmouth, in a single day, must be pickled, or sprinkled with salt for immediate export, within 24 hours. The British public, long since accustomed to abundant supplies of fresh fish, has no taste for pickled herrings. Normally, in pre-war days, at least 80 per cent. of the total herring catch of the United Kingdom was exported, mainly as pickled herrings, and chiefly to Germany and Russia. The industry was faced with catastrophe; trade with Russia was impossible, and with Germany only possible on a credit basis, but the bulk of the curers were men of small capital, used to selling their herrings as soon as they were pickled, and using the money thus realised for the purchase and preservation of more; the industry was bound to come to a standstill unless help could be provided.

These most exceptional circumstances were held to justify the direct financial subvention of the industry by the Government. The mere fact that the industry appealed to the Government for financial assistance and was prepared to tolerate the interference which such assistance must involve, was, to those familiar with its spirit of sturdy individualism and almost truculent independence, strong evidence of the bitter necessity of its case. The deciding factor, however, was not so much the clear evidence that an important industry of the country was liable to be brought to a standstill, or that the country stood to lose an export trade which, from the nature of it, counted almost as a net gain on the balance of trade, as that this particular industry had proved to be of great consequence to the country at the most critical period of its history. The fishermen, who were faced not merely with unemployment but with the loss of everything on which their employment depended, had proved themselves to be a vital factor of the national defence, and were able with undeniable justice to urge that, inasmuch as they as a body had risked everything for the country, they were entitled to such aid as was necessary to enable them to re-establish their industry. This view was accepted by the Government and financial assistance was given on a generous scale.

The question has been asked—" Why should a State subvention be provided for the herring fishery industry, and denied to the trawlers? "—The answer is simple. The herring fishing industry, and, with it, the supply of herrings for home consumption, depends absolutely upon the maintenance of foreign markets. In existing conditions and such conditions as must subsist for some time to come, no other outlet can be provided for the bulk of its produce. The trawling industry, on the other hand, depends almost wholly on the home market; and, although the enormous increase of the cost of everything required for the prosecution of the trawl fisheries, and especially of coal, has heavily taxed that branch of the industry, the trawlers have never been confronted, as the herring fishermen were, with the prospect of the complete and perhaps final annihilation of their industry owing to financial conditions resulting from the war.

Chapter III gives an account of the herring industry for the five years under report, during the first two of which it was financed by the Government. Statements of the financial aspects of this transaction are included in the chapter, from which it will be seen at a glance that, regarding the enterprise as a commercial undertaking, it was a failure. But few will be found to cavil at the decision of the Government to give to an industry which had stood the country in such good stead encouragement, aid and comfort when it was reeling from the effects of a knock-down blow, and needed support and a breathing space in which to collect its strength and to adjust itself to unprecedented conditions.

Whether the second thoughts which led to the renewal of financial assistance in the year 1920 were in fact better than the first thoughts which dictated refusal of any further subsidy, is open to argument. On the one hand, the general conditions of 1920 were even more adverse to the herring trade than those of 1919; on the other, there is some reason to think that the operations of 1920, by maintaining an artificially high cost of production, and, therefore, of selling price, may have somewhat retarded the recovery of the trade by discouraging purchase. The question raised is one to which no decisive answer can be given. On the whole, it appears doubtful whether, if the industry had been denied the assistance it received in 1920, it would have been capable of maintaining the struggle unaided in the difficult days of 1921, and would have held its own and have made a little headway, as it did, in the following years. That the administration of the funds supplied by the Government was practical, rational and, in the light of all the adverse circumstances, economical, cannot be seriously contested. The work of the Executive Committee, carried out in the face not only of trading difficulties which were generally known or anticipated, but also of unforeseen obstacles created by rail and coal strikes, was extraordinarily efficient, and, as the Executive Committee would readily admit, owed much of its success to the inspiration and assistance of certain members of the Ministry's staff. It is but fitting that it should also be placed on record that throughout these difficult years both the herring industry as a whole and the Government, in respect of its endeavours to help it, were deeply indebted for skilled and impartial advice and for active and unremitting assistance, which sadly overtaxed his strength, to Mr. George Slater, of Aberdeen, whose influence over those engaged in the industry is as remarkable as it is well-deserved.

It will be seen from a perusal of the Report that in the year 1919 the Government's financial intervention in the Scottish Herring Industry resulted in a profit to the Government of £233,904 8s. 8d., while the corresponding transaction in respect of the Autumn Herring Fishery of Yarmouth and Lowestoft showed a loss of of £111,683 9s. 5d. Similarly in 1920, the loss on the Scottish fishing amounted to £641,137 6s. 6d., while that on the English fishery was £1,193,759 7s. 11d. In both cases, therefore, the Scottish trading account reveals a happier result than the English. With no wish to belittle the marked capacity of those who were responsible for the administration of the scheme in Scotland, but rather in fairness to those charged with similar responsibilities in England, certain differences between the conditions under which they respectively worked should be remarked.

In 1919, the Scottish scheme was actually run at a profit, but, although it was intended to secure a minimum price of 35s. a cran for the fishermen, it did not enforce such a minimum, and a great part of the herrings were purchased at lower prices. As the Government's price to the curers was based upon the price paid to the fishermen, the Government purchased the cured herrings cheaper, and could afford to sell them cheaper. Further, because the Scottish season commences first, the Scottish herring is the first on the market, and because the Scottish fishing was a light one, the whole of the catch was sold without difficulty. The scheme for the Autumn Herring Fishery of the same year enforced the minimum price to the fishermen, which involved a higher purchase price being paid to the curer; the quantity of herrings involved was considerably greater; the English herrings came later on the market, and those responsible for their sale were further embarrassed by the steady decline of the value of the German mark.

Very similar considerations have to be taken into account in connection with the herring fishery of the year 1920. The Scottish scheme of this year secured a minimum price for the fishermen, but, regarded from a purely financial point of view of profit and loss, it had the advantage over the English one that the fishing was again light, so that the Fishery Board were able to purchase and control the full output, as well as being first in the market. The catch in the English fishing was very heavy, and, after the whole of the guarantee money had been expended, curers continued to purchase fish from the producers at prices much lower than they were required to pay under the scheme.

The Government had, therefore, to compete against 200,000 barrels of privately owned herrings which had been produced more cheaply than those which they had bought. The continued and rapid decline of the value of the German mark also prejudiced sales. As the account indicates, the greater part of the stock in hand was eventually transferred to the Disposals Board for sale.

The total expenditure in respect of the "Herring Guarantees" in the two years amounted to £5,397,380 2s. 1d., of which, after all outstanding bills are met, £3,684,704 6s. 11d. will be recovered. The net cost will, in that case, amount to £1,712,675 15s. 2d., which sum may be regarded as a direct subsidy to the industry. This sum is probably more than has been spent upon the support of any other industry of comparable size, and the whole transaction would probably have evoked severe criticism but for the fact that Parliament realised the great services rendered by the fishing industry during the war. Members of other industries performed their part, but it is doubtful if any industry at the outbreak of war so quickly mobilised both its personnel and its material, and so rapidly became an effective arm of the fighting forces as did the fishing industry.

Since 1920 the herring industry has had to fight its own battles, and the facts recorded in the Report prove that, in spite of the odds, it held its own. In the year 1921 natural forces, leading to an almost complete failure of the herring fishing, came into play. It has been suggested that the comparative failure of the fishing should be regarded as in some sort a blessing in disguise. There was not the heart-breaking disappointment of abundance of fish without a market. The industry was brought down to rock bottom. Many of the fishermen temporarily gave up the herring as a bad job and turned their attention to trawling and seining. So far as the herring industry itself was concerned, it was felt with justice that at any rate things could not be worse, but it was a cruel time not only for fishermen and owners, but also for the large body of shore workers that the herring industry normally employs. The following years witnessed a partial recovery, and the circumstances of the moment, which will fall to be dealt with in a later Report, justify the belief that the recovery will be maintained.

The conditions of 1921 are interesting, not merely in their economic aspects, but also from the scientific point of view. It was a year of unprecedented drought, and the climatic conditions were associated and perhaps not unconnected with an abnormal influx of Atlantic water to the North Sea. There is good reason to think that the lack of herring, and the poor quality of those that were found, resulted from the abnormal physical conditions. This subject falls naturally to be dealt with in the chapter referring to Scientific Research, but is of too great interest to those engaged in the industry to be passed without remark in a section dealing with the future of the herring trade. The experience of 1921 suggests that it may ultimately be possible, by a careful study of the movements of Atlantic water, to foretell good and bad seasons and to account for those extraordinary fluctuations to which the herring fishery is subject.

Motor Loans (*Chapter IV*).

Chapter IV deals with the work of the Motor Loan Committee. The Motor Loan was instituted as a war measure, but the inspiration behind it was the recognition of the value of the men who, working out of the many minor harbours, coves and inlets of our coast, snatch a precarious existence from the sea, undeterred by the primitive conditions of their anchorage, by lack of up-to-date communication with the markets, and, in many cases, by the depressing influence of poor over-crowded houses. It is in the inshore fisheries, above all, that the real traditions of native seamanship are preserved, for the inshore fisherman depends entirely upon his instinct, his sea-sense, his courage, his endurance and his pertinacity.

Economists are apt to urge that, because the inshore fisheries contribute so small a fraction of the total landings of fish, they are not worth preserving, except as an artistic addition to the scenery—an æsthetic luxury which is no concern of the State. Cheap fish, they will tell you, is now almost a necessity of the industrial classes, and the cheapest fish and the greatest quantity of it is brought in by the steam trawler and the steam drifter. The deep sea fisheries are not only the source of this valuable supply of cheap food, but also, in the case of the steam trawler to a considerable extent, and in the case of the steam drifter to a most important extent, the source of a trade with foreign countries which increases our wealth and enhances our credit abroad. All this is true, but more remains to be said. This island country, dependent on its overseas communications for most of the necessities of life, needs seamen—seamen at every point of the coast, seamen who know every cove, inlet, bank and shoal as they know the palms of their own hands, seamen who have learned to rely upon themselves and themselves alone in every difficulty and in every emergency. And if the steam fishing vessels produce the greatest quantity of fish and employ the greatest amount of capital, it is the inshore fishing industry that breeds and fosters the greatest number of natural seamen.

But, it may be said—indeed, it has been said—the assistance given by the State to these men in the form of loans for the improvement of their craft is a charity which will undermine those very characteristics of self-reliance and resource which it seeks to foster. We do not consider that this apprehension has been justified by the event. In a great many cases, as the Report of the Committee shows, until an overwhelming depression overtook the industry, instalments of loans were promptly repaid with interest, and the tendency was for them to be repaid in advance of the date when they were due. War prices, coupled with increased fishing power, brought them for a period unwonted prosperity, and most of them took advantage of it to get out of debt as quickly as possible, and, as it happened, speedily to release to be lent to others the money they had borrowed. They were used to saving painfully and laboriously for the replacement of worn-out gear and of boats damaged or destroyed by the accidents of the sea. It was not, however, always possible to make good the normal or the accidental wastage, and few of them could hope, without borrowing, to provide themselves with the motor engine which might enable them to exist while the steam trawler and steam drifter hands throve. The finest spirit cannot achieve the impossible, and the inshore fishermen are likely from time to time to need a helping hand.

The Motor Loan and its forerunner, the Cornish Loan, completely changed the face of many a small fishing port where creeping disaster was near to culminating in a tragedy of despair. For the time, at any rate, the situation was saved. Only experience can show whether or to what extent the inshore fisheries will be able now to hold their own. For every development there is a penalty to be paid, and the advent of the marine motor in fishing vessels is no exception. The artist laments the loss of the picturesque. The brown-sailed fleets of the western ports are almost a thing of the past; and there may have been some loss of seamanship. But is that all? The advocates of the marine motor for fishing aimed at making the fisherman independent of wind and tide. In particular, they hoped to enable him to go out fishing in a dead calm and to return at his own time to catch the market. They anticipated also that the motor engine would give him a wider range of fishing. All this has been achieved, but one unexpected development has given rise to some heart searchings. The sailing boat required sea room, and, therefore, tended to stand out from shore as far as it dared. The master of the motor vessel, though he can well afford to go further out to sea, can also afford, relying upon his mechanical power, to hug the shore. There have been complaints that the motor vessels with this new-found security have over-trawled the inshore grounds, and have destroyed, or are destroying, the young stock which formerly found sanctuary close to the coast. That there is a tendency to hug the coast more closely appears, at any rate in some localities, to be a fact. Whether there is serious risk of injury to the stock is a question which is engaging the attention of the Department. It is too early as yet to pronounce a verdict upon this point, but if it should prove that the introduction of the marine motor has led in some cases to wasteful fishing, it should not be impossible to overcome the difficulty by regulations, and such regulations could be imposed with little hardship having regard to the greatly increased mobility afforded by the motor engine.

Insurance of Fishing Vessels (*Chapter V*).

The Insurance Schemes for Fishing Vessels initiated as war measures were brought to an end in the year 1920. Our last Report contains a full account of these schemes, the first of which, operated by the British Fishing Vessels War Risks Insurance Association, embraced all the larger types of fishing craft and was brought to an end in February, 1920. The second, operated by the Cornish Fishing Vessels Insurance Society, which for this purpose extended its operations to the whole of the coasts of England and Wales, was brought to an end in July, 1919, though in fact the Government indemnity against war risks was extended for a year longer. The justification for those two schemes was the necessity of keeping at sea as many as possible both of the fishing vessels of all sorts and of the fishermen available after the demands of the Admiralty had been met.

The major scheme for deep sea fishing vessels involved a net loss to the Government of some £996,000, incurred mainly in the early years of the war, before measures of protection such as were adopted in the later stages were feasible. On the minor scheme for inshore vessels, the Government incurred a loss of approximately £7,000. The words profit and loss are not, strictly speaking, appropriate in this connection. Neither scheme was regarded as a commercial venture. The Government merely accepted certain liabilities in furtherance of an object closely affecting the safety and the provisioning of the nation.

During the year 1919 the insurance of fishing vessels entered upon a new phase. For the vessels covered by the Government War Risks Scheme adequate facilities for ordinary insurance existed, and no further provision of insurance facilities by the Government was necessary. But the smaller inshore craft had, except in Cornwall, no means of insurance corresponding to their needs. On most parts of the coast there was no such concentration of fishing vessels of this type as would permit of the formation of a society of sufficient numerical strength to afford protection under a scheme of mutual insurance, nor was there any insurance company trading for profit which was prepared to insure these vessels at rates which the owners could afford to pay. The reason for this is not far to seek. The collection of premiums, the examination of claims and the conduct of surveys in respect of a large number of comparatively low valued craft scattered in almost inaccessible ports and coves from end to end of the coast involves in the ordinary course of events heavy management expenses, and a company which set out both to meet these expenses and to show a profit would be bound to charge a relatively high premium. At the same time, it was imperative to give to the inshore fisheries at least that degree of financial stability which a sound scheme of insurance can confer, and the Government, accordingly, decided, for the time being, to undertake direct responsibility for the insurance of inshore craft. An account of the scheme and its working will be found in Chapter V, from which it will be seen that it has not paid its way. At the date (31st March, 1923) up to which the Report carries its account of the Insurance Scheme, the scheme was in process of being wound up, but it is hoped that before the protection accorded by it is removed, some other and not less sympathetic organisation will have been found to carry on the work.

With regard to the loss on the scheme, we are, though disappointed, wholly impenitent. Some such scheme was essential for the maintenance of the inshore fisheries. It was always hoped that the scheme might be made to pay its way. It was never intended that any profit should be made from it, but rather that any surplus should be placed to the reserve. There is no reason to suppose that the scheme cannot be made self-supporting in the course of time, and it is in the confidence that it will be self-supporting that the Department is prepared to transfer it without misgivings to other hands.

Scientific Investigations (*Chapter VI*).

Considering how short a period has elapsed since the most devastating war in history, the record in Chapter VI of work done in the field of scientific research is a legitimate subject for congratulation. It is to the credit particularly of the sympathetic understanding of the Development Commissioners and their advisers that, at a time of unprecedented financial difficulty, not only the Fisheries Department, but the scientific institutions with which it works and which could not remain fully efficient without assistance from the Exchequer, are better equipped for marine research than at any previous period. In the circumstances, it may appear ungracious to point out that the pre-war equipment in this respect did not approach any reasonable standard of adequacy, and that the present equipment falls far short of that which is both desirable and necessary. Excellent work is being done with the material available, but it cannot be too frequently stated that marine research is so full of complexities, the area it must cover so vast, and the medium in which it is carried out so obscure, that the elucidation of the problems with which we are confronted demands the concentrated effort of many men and many ships.

Scientific research at sea is largely a matter of generalisation by deduction from collected samples. We cannot see what is going on at the bottom of the sea or in the middle waters, and so with various ingeniously constructed though, as yet, necessarily imperfect instruments we take samples of water, of temperatures, of plankton, of fish and of bottom deposits, and endeavour on scientific principles to reconstruct the whole from these small parts. It is a process requiring ability of a high order applied to its task with patience, industry and, above all, unswerving honesty. Obviously, the greater the facilities for the acquisition of comparable data the greater may be our hopes of accurate deduction from them. On this account it is greatly to be desired that the Department may in due time have more ships equipped for scientific research and a larger staff of qualified workers at its disposal.

The difficulties inherent in marine investigations, that is to say more particularly in the complexity of the subject and the extent of the area to be investigated, are in part met by the co-operation of Great Britain and other countries through the medium of the International Council for the Exploration of the Sea. Unfortunately, most of the other countries are feeling so acutely the financial repercussions of the war that they are not able to equip and maintain in regular commission well-found research ships. Denmark alone has a research ship comparable with those of the English Department and of the Scottish Fishery Board. It is actually a ship of the same type—the Mersey trawler type. France, whose adhesion to the International Council since the war has brought a valuable and welcome accession of strength, carries out an active programme of research at sea by means partly of its research vessel "La Tanche," and partly of men-of-war of the French Navy. Admirable, however, as her work is, it suffers from the lack of a research vessel really suitable, as are those of England, Scotland and Denmark, for work of this kind, and in constant commission. Norway, one of the pioneers of marine research, has not equipped a ship for deep sea research since the war.* Of the others, Sweden has recommissioned the "Skagerak," but finds difficulty in keeping her regularly at sea owing to the prohibitive cost of coal. Belgium has recently acquired the small ship "Oithona" from the Marine Biological Association; but she is unfit for distant voyages. None of the others have ships dedicated to research and suitable for deep sea work.

It must not be assumed that the countries which have not research ships in commission are not active participators in the programme of the International Council. Their activities are necessarily restricted, but their experts, by advice in the formulation of programmes, by work in proximity to their coasts and by assistance in examination of material collected not only by themselves but by others, make valuable contributions to the success of the work as a whole. Desirable as it may be that every participating country should undertake its part in the sea work, it is necessary to remember that no amount of collection of material at sea is of value unless the work is directed and the collected material examined by the best available scientific intelligence. The International Council for the Exploration of the Sea focuses upon some of the more urgent problems of the sea fisheries the intelligence of the best qualified experts of nearly a dozen countries.

Chapter VI does not attempt to answer the question which is most frequently addressed to the advocates of marine research—"What practical results have you secured or do you expect to secure?"—and this is not the place to attempt to answer the question in detail. On the other hand, the question must not be evaded. The taxpayer is entitled to know whether, and, if so, in what respect he is getting value for his money; the fishing vessel owner and the fisherman whether the money which Parliament votes for the development of the fishing industry is being spent to the best advantage. In short, they are entitled to some assurance that marine research as conducted or aided by the State has a definite and practical objective, and is not merely the pastime of a Department indulging in intelligent but unpractical curiosity at their expense. The fisherman who is groaning under trade depression and the high costs of production cannot be blamed if he demands immediate relief from his present anxieties rather than the vague prospect of benefits to accrue to future generations. To the question—"Do you think that at the present rate of development of fishing power and energy there will be enough fish to go round 50 years hence?"—one trawler owner frankly replied—"I don't know and I don't care; I shall be dead"—and in so saying he summed up the philosophy of many. The Department, which is in some sort the trustee not only of the present but of future generations, cannot take so narrow a view. Nor must it be thought that mere conservation of the stock is the sole or even the main object of marine research. The first and last concern of a Fisheries Department must be to foster for the benefit of the fishermen of its own country the rational exploitation of the sea, and the first essential of rational exploitation is knowledge of that which it is proposed to exploit. Without such knowledge not only is intelligent administration impossible but the practice of fishing is almost inevitably wasteful either of time and energy or of fish, if not of all three. We hope—and recent developments have encouraged the hope—that the knowledge we are acquiring will enable us to conserve the stock, perhaps even in some cases to develop it, to prognosticate good and bad seasons for different fisheries, to indicate by simple tests where good fishing may be expected at any given moment, and, in short, to enable the fishermen to get the maximum amount of good marketable fish with the minimum expenditure of time, labour and money, and with the least prejudice to future supplies. When we have reached this point, our research work will have been justified beyond challenge. In the meantime, we ask for patience, faith, and, all important, imagination.

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* The "Michael Sars" has recently—in 1924—been recommissioned for deep sea research.

Can we refer to any achievements of marine research by which patience may be supported, faith encouraged and imagination stimulated? Surely the actual achievements of so comparatively young a science are full of encouragement. It has demonstrated that an intimate relation exists between the movements of sea water of high or low salinity and temperature and the migration of fish, and again between the physical condition of the sea and the development of the plankton organisms which play so great a part in the food of fish at various stages. It has revealed many, if not most, of the facts regarding the breeding habits of food fishes; in particular it has shown that the eggs of most of them, except the herring, float in the surface layers of water, thus removing from the trawl the reproach that it destroyed eggs of fish. It has taught us so much about the feeding habits of different fishes that we know, for instance, that the finest pasture available for the North Sea plaice is on the Dogger Bank, where they grow at a greatly accelerated rate and that different forms of plankton are the food of different fishes and of fishes at different stages of their life. It has revealed to us the mysteries of the life history of the eel, and has shown us how knowledge of it may be practically applied. It has taught us how to read the age of fishes, and has thus assisted us in our efforts to estimate the stock and to study the effects upon it of intensive fishing operations and to gauge the prospect of maintaining an adequate supply in spite of them. It has instructed us in the migrations of some of the most important food fishes, and both the regularities and the irregularities of such migrations, and it has taught us many other things which are now such familiar facts that we are disposed to think that we have always had an intuitive knowledge of them. We cannot yet promise as a result of science the strictly economic cultivation of the sea fisheries, or invariable prognostication of good and bad fishing, but from year to year we are so greatly increasing our knowledge that we are entitled to believe that at the least neither is beyond the bounds of possibility.

When we reach the stage of the practical application of the results of scientific research, the value of the International Council will be finally demonstrated. The greater part of the fish supply is taken in international waters. The adoption, therefore, of measures for the protection, development and rational exploitation of these fisheries, whatever form those measures may take, must needs be international, for it would be useless for one nation to endeavour to apply them without the concurrence and co-operation of the other nations which fish the same waters. International agreement on measures for the development of the international fisheries should not be difficult to secure when those measures are in fact a practical application of conclusions reached by international investigation. Broadly speaking, it may be said that the interest of each nation in the international investigation is proportional to its interest in the fisheries investigated, and Great Britain, having incomparably the greatest interest in the fisheries, stands to gain most from these international studies. The financial support given by Great Britain, alone of the belligerent nations, to the International Council during the war period and the invitation given by H.M. Government to the Council to hold their first meeting after the war in London were due in part to a recognition of this important fact. But every country which fishes in the sea has an interest in these investigations. Most of them have begun to recognise that the future of the fishing industry, as of all industries, lies in the lap of science; not all of them have yet had the wit to recognise the futility of spasmodic and unorganised inquiry. Experience will compel them to recognise it, and the International Council, with a reputation firmly established by 20 years' work, probably much more conscious of its own deficiencies than any of its outside critics, and fully determined to get rid of them, anticipates with some confidence that not many years will pass before those who at present stand aloof will seek admission to it.

Shell-fish (Chapter VII).

The branch of shell-fish fisheries which has chiefly engaged the attention of the Ministry is that concerned with molluscs, and particularly with the two molluscs which are of principal commercial importance, namely, the oyster and the mussel. It may appear that the space devoted to this branch of the fisheries is greater than its importance warrants. It must be remembered, however, that the shell-fish fisheries are of great value to the inshore fishermen on certain parts of the coast, and in fact provide them with the principal part of their livelihood during the winter months, that they have a considerable intrinsic value and are capable of great development, and that the industry is one which has a very close and well-defined relation to important questions of public health. It is, therefore, right and necessary that the Ministry should pay serious attention to them.

Oyster Mortality.

The oyster fisheries have demanded special attention owing to the outbreak, in the year 1920, of an alarming mortality among oysters, first observed in the Thames Estuary. This mortality appeared at first to be local, but it broke out—or, at any rate, was observed—subsequently in other districts, and not only in the United Kingdom but also abroad. A brief account of the outbreak and of the measures taken in connection with it will be found in Chapter VII, and a full report of the investigations undertaken in the endeavour to account for it has been published.*

So far as can be judged, the disease which attacked the oysters has spent itself, but it lasted long enough and was sufficiently intense more than to decimate the stock—in some places, indeed, almost to annihilate it—and to reduce all except the strongest companies of oyster planters to the verge of bankruptcy. So far as the knowledge of fishermen and planters went, the outbreak was without precedent and it was natural that a cause should be sought for it arising out of the war. It was known that in various places off the coast, and in particular at one spot in the Thames Estuary, considerable quantities of waste ammunition had been dumped in the sea, this being the most convenient and the safest way of getting rid of it. Those engaged in the oyster industry not unnaturally jumped to the conclusion that the mortality among oysters was due to poisoning caused by dumped material, and it was generally assumed that the substance known as T.N.T. was chiefly responsible for it. The Department, which was cognisant of the dumping and had been consulted by the responsible authorities as to the places where dumping could safely be carried out, was sceptical, but kept an open mind. The matter was fully discussed with the Oyster Merchants and Planters' Association, and, financial assistance having been obtained from the Development Commissioners, investigations were set on foot, towards the expenses of which the Association contributed. Dr. Orton, of the Marine Biological Association of Plymouth, was selected to be the biologist in charge of the inquiry, and he was assisted in respect of bacteriological inquiries by Dr. Eyre of Guy's Hospital, and on the chemical side by Dr. Brady of University College. The whole investigation has been of the most thorough, comprehensive and painstaking character, but the causes of the mortality are still shrouded in obscurity. If the investigation could be said to have established anything regarding the character of the disease, it would appear to be conclusive against the theory that the disease is attributable to the action of T.N.T. or of any of the other chemical substances, falling under suspicion as having been dumped or as being likely to be present in vessels which had been sunk during the war, which have been under examination in connection with the inquiry. It appears probable that some other and less obvious cause, associated perhaps with the abnormally cold conditions of the year 1920, is in fact responsible. For the present it can only be said that investigations conducted in this country, as well as those conducted in France and in other countries abroad, have failed to yield a satisfactory explanation of the abnormal death rate among oysters.

The investigation was rather hampered by the fact that very little is really known about the feeding and the physiology of oysters. Knowledge of these subjects is of fundamental importance to the successful investigation of the causes of a particular disease like that with which we are concerned, and they are now being studied. It is unfortunate that no conclusive explanation of the mortality should have been obtained. In spite of Dr. Orton's results and the full report of his investigations which has been submitted to the Association, some of the oyster merchants appear to remain convinced that the mortality was due to dumping, and, in particular, to T.N.T. poisoning. Indeed, they have maintained that they are entitled to compensation from the Government in respect of it, and it is understood that, in spite of the conclusions of the investigator selected by themselves as an independent and impartial witness, they have not abandoned their claim.

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* See footnote, p. 94.

Oyster Breeding.

A more hopeful aspect of the oyster industry is provided by the experiments which the Ministry has been conducting at Conway in the breeding of oysters under control in tanks. Those experiments, of which some account will be found in the chapter dealing with shell-fish, although they have been attended by a good deal of bad luck, point to the possibility of restoring depleted beds with oysters bred under conditions which favour rapid and healthy development at an economic cost.

It happens fortunately that the breeding season for oysters falls during the summer, that is to say, at a time when the mussel cleansing tanks are not in use for the purpose for which they were designed, and can, therefore, be used for oyster breeding experiments. Accessory tanks are also now available for the more intensive study of this problem, which could originally only be taken up in a very inadequate fashion as a side line owing to the demands of other work on the small staff available. It is unfortunate that since these investigations were taken seriously in hand only one good spat-fall has occurred, and that circumstances made it impossible to take full advantage of it. Enough has, however, been done to show that oysters can be successfully bred in tanks, and that young oysters thus secured can be transported successfully to suitable grounds for their further development.

Oyster Cleansing.

Investigations are also in hand, by means of tanks specially designed for the purpose, to test the possibility of applying to polluted oysters the method of cleansing which has been successfully adopted in the case of mussels. The difficulty which it has been necessary to overcome is that oysters, being more susceptible to the effects of cold, which has the effect of preventing them from functioning in a normal way, can only be satisfactorily cleansed during the season—that is to say, during the winter months—if arrangements can be made to prevent the temperature of the water in the tanks from falling below a certain level.

Mussel Cleansing.

The cleansing of mussels has been successfully continued at Conway, and the possibility of applying the methods adopted at

Conway to other areas is being tested by means of tanks erected at Lympstone in the estuary of the Exe. A succession of accidents, attributable partly to unfavourable weather, but very largely to faulty engineering, has unfortunately made the cost of the Lympstone tanks considerably higher than in less unfavourable circumstances it would have been. Similar causes have inflated the prices of various extensions and improvements of the tanks at Conway. It is, however, satisfactory to be able to record that, in spite of increased costs, the deficit incurred in the earlier years of mussel cleansing work carried out at Conway has latterly been materially reduced.

The fact that the first mussel cleansing tanks were erected at Conway is due to the presence in the estuary of mussels of very good quality which are heavily polluted, and to the enterprise of the Corporation of the Borough of Conway, who were determined that the livelihood of the fishermen, dependent upon these mussel beds which had fallen into disrepute owing to their pollution, should be restored. The early history of the tanks has already been dealt with in the last Report* issued by this Department. The subsequent history is one of success in the face of very discouraging circumstances. The most discouraging circumstance lies in the character of the general body of Conway fishermen. The mussel tanks originally erected by the Corporation and subsequently taken over, controlled and worked by the Ministry, were erected for their benefit and for the benefit of the public health of the community. Their refusal, through distrust of the Ministry's motives, to take advice and their own internecine quarrels have made the task of the Ministry, in endeavouring to secure a better livelihood for them and at the same time to protect the public health, one of extraordinary difficulty and discouragement.

The pollution of shell-fish beds raises issues which cannot be avoided, and the present position of the Ministry with regard to this question is one of extreme difficulty. The interests of the public health demand that the distribution of polluted shell-fish for human food should not be permitted, and it must be added that the interests of the shell-fish industry also demand this, because an outbreak anywhere of an epidemic of typhoid which can be traced to the consumption of shell-fish would prejudicially affect every single shell-fish fishery in the country. Even to discuss this problem of pollution—as the Ministry is bound to do—is liable to excite apprehensions which may reflect prejudicially upon the industry, for many may be inclined to argue that the safest course is to eat no shell-fish, and thus to avoid the risk of eating the wrong ones. Happily, however, so far as the Ministry is aware, there has been, in recent years, and especially since the Conway cleansing station was opened, very little evidence of disease traceable to the consumption of shell-fish.

The Ministry has sought to safeguard the interests both of the community as a whole, and of the fishermen, by evolving a system of cleansing mussels which is in itself perfectly satisfactory. This system can be applied, without cost to the State, in the case of fisheries capable of producing annually a certain quantity of fish.

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* See footnote, p. xvii.

Even in the case of such fisheries as these difficulties arise, as the Report in Chapter VII will show, owing to such causes as failure of the fishermen adequately to cultivate the stock, or their failure adequately to fish the fishery—in other words, to produce the necessary output to pay the cost of cleansing—when prices fall, owing to foreign competition or other causes, to an unattractive level. Ordinarily, however, it may be said that the larger fisheries can be dealt with under the Ministry's system of cleansing, but what is to be done with the smaller ones? It must be remembered that at many points there are small communities of fishermen to whom the local mussel fishery—often greatly polluted—has regularly furnished a livelihood in the bad weather of the winter months when other fishing operations were too difficult or too dangerous. The closing of the mussel fisheries would involve serious harship for such communities, but it appears to be inevitable. The importance of these mussel fisheries does not lie in their contribution to the market, for all that is required could be produced from the larger fisheries. It is only because these fisheries have provided a valuable winter side-line that any compunction need be felt about closing them, and unless and until means can be devised for cleansing small quantities of mussels at a reasonable cost, no alternative to closure seems to present itself.

Reference has been made in the main chapter to surveys of some of the shell-fish beds carried out by the Ministry a few years ago. The Ministry has only a limited staff available for the investigation of these shell-fish questions, but it proposes to make a serious endeavour in the near future to conduct a complete and comprehensive survey of all shellfish beds, with a view to arriving, in consultation with the Ministry of Health, at definite conclusions as to the steps which must be taken in connection with each one of them for the protection, on the one hand, of the public health, and, on the other, of the interests of the shell-fish fisheries as a whole. It cannot be too often or too emphatically stated that it is as important from the point of view of the fisheries to create a well-founded sense of security in the public mind as it is from that of the public health to ensure that the security shall be real and unimpeachable.

Whatever measures it may be found necessary to adopt, it is essential that means should be available to put them into effect. It is not enough that Orders should be made, printed and published; they must be enforced. It is probable, therefore, that legislative powers will have to be sought to deal adequately with this difficult problem.

Shell-grit.

The closing of the shell-grit factory at West Mersea was a great disappointment to the Department. It must be remembered that, as explained in the last Report,* the shell-grit factory was not established with the idea of running it as a State profit-making concern, but with the sole purpose of finding a means of making the slipper limpet pest pay for at any rate part of the cost of combating its invasion of the oyster grounds. The Ministry had always hoped that if it could successfully establish the business it might eventually be handed over to a co-operative society of fishery or oyster merchants, or a combination of both, to be run in the interests of the fishing industry of the Thames Estuary as a whole. The Ministry was anxious that the industry should be conducted, if not by itself, then by some co-operative body interested in the protection and development of the fisheries, in order that, whatever other purposes the industry might serve, all should be subservient to the purpose for which it was originally founded.

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* See footnote, p. xvii.

The enterprise was defeated mainly by the renewed competition of American oyster shell-grit, and the indifference of the home distributors and consumers. As regards the relative merits of American oyster shell-grit and the grit produced by the Ministry from the slipper limpet, there is no reason whatever, in the light of experience, to doubt that the Ministry's grit was, for the purpose for which shell-grit is used, at least as good as the American product. The Ministry's grit, which, owing to the circumstances of its production, contained a certain small proportion of flint, which is of no value for shell production but is of value for digestive purposes, was proved in use to produce as good a shell as any shell-grit on the market. The presence of a certain proportion of flint was probably more than compensated for by the absence of dust. Here, therefore, we had a home-produced commodity the production of which was of benefit to another home industry, but, unfortunately, it too often proves that neither patriotism nor common sense is proof against established habit, and the Ministry was never able to secure the whole-hearted support of those who might have crowned its efforts with success. The temporary failure of this enterprise is a misfortune for everybody concerned. In particular, a market for the slipper limpet, the existence of which might have helped in the fight against this destructive pest, has been lost, and the poultry industry is purchasing abroad, against an adverse rate of exchange, necessary material which, or a great part of which, could be produced at home.*

Proceedings under Acts, Conventions and International Law (Chapter VIII).

Chapter VIII contains a brief report of proceedings under Acts, Conventions and International Law. In so far as domestic legislation is concerned, the Report is mainly formal. Under international conventions and the unwritten International Law, questions arise, and have recently arisen, of serious import to the fisheries, some of which we may be in a position to discuss at more length in a later Report. It is not generally recognised how considerable are the demands made upon the time and attention, not merely of the Fisheries Department, but also of the Board of Trade as the Department charged with administrative responsibility for international conventions, and the Foreign Office as responsible for all international relations, by the sea fisheries. The greater part of the fish which we consume is taken in waters in which every other nation is free to fish. In order to regulate fishing operations, and, in particular, to prevent or to adjust disputes between the fishermen of different nationalities, Great Britain has entered into international conventions in respect of the frequented fishing grounds of the North Sea and the Channel. There is, however, as yet, no general convention which applies to all fishing grounds, and to which all fishing countries are parties. Questions, therefore, arise which, not being covered by any convention, can only be dealt with in terms of international law and international comity; of these the most frequent is that of the violation of territorial waters. This question may take two forms. On the one hand, certain countries have claimed territorial jurisdiction beyond the three-mile limit, to which limit successive British Governments have consistently adhered; and on the other, territorial waters, that is to say, waters within the three-mile limit, are from time to time illicitly exploited. The question in its first form is of vital importance to the British fishing industry. So far as their bunker capacity permits, British trawlers are ubiquitous. Trawling is carried on from British ports in the waters off Iceland, the Murman coast of Russia, and the Northern and North-western coasts of Morocco. Between those points, our fishermen fish along the whole of the Continental Shelf. Trawling can only be carried on in comparatively shallow waters, and the trawlable part of the Continental Shelf is narrow. Every claim, therefore, to an extension of territorial jurisdiction so as to exclude them from any part of the waters which they at present fish is and will be hotly contested. Regarding the question in its other aspect, it has to be admitted that fishermen the world over have an incurable itch to catch fish and little respect for international boundaries, except such as the visible presence of a fishery protection cruiser may enforce. In short, there are cases, not a few of them, of wilful trespass in territorial waters. There are also cases of excess of zeal on the part of the commanders of fishery protection cruisers, and nice questions arise from time to time as to the actual position of a ship whose arrest is effected admittedly near the borderline, or as to whether she was in fact fishing, had her gear properly stowed, or not, or was otherwise guilty of any breach of regulations, which sometimes necessitate the intervention of the Fisheries Department, the Foreign Office and the Board of Trade, each in its respective sphere.

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* Since this Report was written the trade in this home-produced shell-grit has revived and there are indications that foreign competition will be successfully met.

REPORT FOR THE FIVE YEARS 1919 to 1923.

CHAPTER I.—REVIEW OF THE FIVE YEARS' FISHING.

Produce of the Fisheries.

The outstanding feature of the year 1919 was the rapid recovery made by the industry in England and Wales from the low ebb of production at the beginning of the year to practically a normal output at its close. With 1920 therefore a new period opened, production being practically normal; but in common with other industries, the standard of value remained very high. As a basis of comparison it seems advisable to consider the pre-war year 1913, which was a year of maximum production, as a measure of the years under review. In the following Tables, therefore, the subsequent years have been shown as percentages of the figures for 1913.

Table A.—Total Quantity, Value, and Average Value per cwt. of British Wet Fish and Proportion per cent. as compared with 1913.

Year.	Quantity of Wet Fish landed.	Per cent. of 1913.	Total Value (including Shell Fish.)	Per cent. of 1913.	Average Value per cwt. of Wet Fish.	Per cent. of 1913.
	Thousands of cwts.		Thousands of £.		£ s. d.	
1913	16,152	100	10,337	100	12 5	100
Mean of 1915-18	4,691	29	9,830	95	2 1 3	332
1919	10,308	64	19,033	184	1 15 11	289
1920	14,584	90	21,818	211	1 9 1	234
1921	11,175	69	16,557	160	1 8 8	231
1922	12,159	75	14,291	138	1 2 9	183
1923	11,514	71	14,296	138	1 4 1	194

In 1919 the landings were more than double the war average, but there was a deficit of nearly 6 million cwts. as compared with 1913. The 1920 figures show a great improvement, the quantity being more than three times as large as the war average, and about 4¼ million cwts. greater than in 1919; it fell short of the 1913 quantity by 1½ million cwts. but apart from that year and 1912 when 14,612,000 cwts. were landed, it was the largest catch on record. In 1921, however, the total fell nearly to that of 1919, the decrease being chiefly due to (1) the extremely bad herring season and (2) the coal strike which limited activities in the early summer. In 1922 the catch rose again by nearly a million cwts. but nevertheless was almost 2½ million cwts. less than in 1920 and as much as 4 million cwts. below the 1913 level. In 1923 there was a decline of 650,000 cwts. but the quantity was still above (by some 350,000 cwts.) that of 1921.

The value realised in both 1919 and 1920 was very much greater than in any former year, being in 1919 almost double, and in 1920 more than double, the pre-war record value of 1913. In 1921, despite the greatly reduced quantities, the value fell to only half as much again as in 1913 and there was a further substantial drop of £2¼ million in 1922 although the quantity was 9 per cent. larger than in the previous year. In 1922, with only three-quarters of the 1913 quantity, the total value was nearly 40 per cent. above that of 1913. In 1923 the total value was practically the same as in the previous year.

The quantities landed having been less, the average value per cwt. shows an even larger increase as compared with 1913; it was nearly three times as large in 1919, 2⅓ times as large in 1920 and 1921 and nearly double in 1922 and 1923. But compared with the average of 1915-18, the values for the years 1919-22 show a continuous fall. In 1913 the average value per cwt. was 12s. 5d. and in 1914 15s. 6d.; in the first complete war year it had risen to 25s. 7d., rising again in the two following years to 34s. and 45s. 2d. respectively, and reaching the high maximum of 60s. 5d. in 1918. In 1919 there was a very marked fall to 35s. 11d. and a further but less marked fall in 1920 and 1921 to respectively 29s. 1d. and 28s. 8d. The following year a further drop brought the average to 22s. 9d.—83 per cent. above the 1913 figure. In 1923, however, there was a rise to 24s. 1d.—94 per cent. above the 1913 figure.

Demersal and Pelagic Fish.

In the following Table the landings of demersal and pelagic fish are compared.

TABLE B.—QUANTITY OF DEMERSAL AND PELAGIC FISH AND PROPORTIONS PER CENT. AS COMPARED WITH 1913.

	Demersal.			Pelagic.		
	Thousands of cwts.	Per cent. of Total Wet Fish.	Per cent. of 1913.	Thousands of cwts.	Per cent. of Total Wet Fish.	Per cent. of 1913.
1913	8,361	52	100	7,785	48	100
Mean of 1915—18	3,334	71	40	1,353	29	17
1919	6,381	62	76	3,926	38	50
1920	9,506	65	114	5,076	35	65
1921	7.867	70	94	3.306	30	42
1922	9,007	74	108	3,148	26	40
1923	8,122	71	97	3.389	29	44

In 1919 the quantity of demersal fish showed a great improvement on the war period average, being almost twice as large, but was nevertheless only three-quarters of the 1913 quantity. In 1920 the catch was as much in excess of that of 1919 as the latter was of the average of 1915-18 and was 14 per cent. greater than in 1913; it was indeed, the largest catch of demersal fish on record, exceeding the previous record of 9,000,000 cwts. in 1907 by half a million cwts. In 1921 the restricted fishing consequent upon the coal strike reduced the total to 6 per cent. less than in 1913, but in 1922 the catch again exceeded 9 million cwts., was second only to that of 1920 and was larger by 8 per cent. than in 1913. In 1923 there was a fall to 3 per cent. below the 1913 level.

The catch of pelagic fish, which had fallen to a much lower ebb than the demersal, showed a larger proportionate recovery in 1919 than did demersal, but although there was a further increase in 1920, this increase only amounted to 29 per cent. as against 137 per cent. the previous year. Compared with 1913 the 1920 quantity was 2¾ million cwts. or 35 per cent. less, but it must be remembered that the 1913 catch of pelagic fish was exceptionally heavy, exceeding by nearly 2 million cwts. the previous largest catch (in 1912) of 5,850,000 cwts. Compared with this latter quantity, which closely approximates to the average of the five pre-war years 1909-13 (5¾ million cwts.), the 1920 catch was deficient by little more than ¾ million cwts. In 1921 the catch of pelagic fish fell to just over two-fifths of that of 1913 and there was a further slight fall in 1922, which was, however, rather more than made up in the following year. The poor result in 1921 was chiefly due to fewer herrings appearing on the usual grounds but the uncertainty of an outlet for the cured products, owing to the disorganised state of the foreign markets, was also a contributing cause. In 1922 the herrings were more plentiful but, owing to the previous bad season and continued poor outlook for export, fewer boats were equipped and, the shoals appearing later than usual, many Scottish boats had departed before the heavy catches commenced.

During the four years 1919-1922 the average value per cwt. of both kinds declined each year from the maxima of 1918 of 80s. for demersal and 24s. 7d. for pelagic. These values were respectively 4½ and 3¾ times those ruling in 1913. In 1919, as will be seen from Table C, there was a relatively heavy fall in

Table C.—Average Values per cwt. of Demersal and Pelagic Fish and Proportions per cent. as compared with 1913.

	Demersal		Pelagic.	
	£ s. d.	Per cent, of 1913	£ s. d.	Per cent. of 1913.
1913	17 10	100	6 6	100
Mean 1915-18	2 10 8	284	1 0 9	319
1919	2 8 10	274	14 10	228
1920	1 17 10	212	12 8	195
1921	1 17 0	207	8 7	132
1922	1 7 11	157	7 10	121
1923	1 10 8	172	8 5	129

demersal to 2¾ times and in pelagic to 2¼ times, the 1913 values. The fall continued in 1920 but was not so marked, the average value of demersal (37s. 10d.) being rather more than double, and that of pelagic (12s. 8d.) being rather less than double, those of 1913. In 1921 there was a further slight fall in demersal, but pelagic, chiefly owing to the poor quality of the East Coast herring, dropped heavily to only a third higher than 1913. In 1922 there was almost as pronounced a drop in demersal as in 1920, the average (27s. 11d.) being reduced to about half as much again as in 1913. In the case of pelagic the fall was less, amounting to 9 per cent. compared with 1913, the average, which stood at 7s. 10d., being higher by one-fifth. In 1923 the downward movement ceased, the average value of demersal showing an increase of 10 per cent. and that of pelagic an increase of 7 per cent. as compared with 1922; the 1923 averages were, respectively, 72 per cent. and 29 per cent. higher than in 1913.

Demersal Fish.

The quantities of each of the principal kinds of demersal fish landed are given hereunder (Table D) in summary form, together with the quantities of these kinds expressed as percentages of the total demersal fish.

TABLE D.—QUANTITIES OF THE PRINCIPAL KINDS OF DEMERSAL FISH, AND PROPORTIONS PER CENT. OF EACH KIND TO TOTAL QUANTITY OF DEMERSAL.

	1913.	Average 1915-18.	1919.	1920.	1921.	1922.	1923.
	Quantity (Thousands of cwts.).						
Cod	2,647	993	1,556	2,506	2,039	2,326	2,045
Haddock	1,554	1,007	2,131	2,732	2,186	2,498	2,037
Plaice	699	251	668	909	656	770	697
Hake	621	106	478	829	616	741	680
Whiting	427	170	281	412	384	317	321
Skates and Rays ...	359	150	245	357	375	439	448
Coalfish	363	111	185	295	247	329	290
Ling	214	42	107	182	171	196	159
Soles	67	22	45	82	83	101	87
Turbot	65	16	61	115	97	96	77
	Proportion per cent. to total Demersal.						
Cod	31·7	29·8	24·4	26·4	25·9	25·8	25·2
Haddock	18·6	30·2	33·4	28·7	27·8	27·7	25·1
Plaice	8·4	7·5	10·5	9·6	8·3	8·5	8·6
Hake	7·4	3·2	7·5	8·7	7·8	8·2	8·4
Whiting	5·1	5·1	4·4	4·3	4·9	3·5	3·9
Skates and Rays ...	4·3	4·5	3·8	3·8	4·8	4·9	5·5
Coalfish	4·3	3·3	2·9	3·1	3·1	3·7	3·6
Ling	2·6	1·3	1·7	1·9	2·2	2·2	2·0
Soles	0·8	0·7	0·7	0·9	1·1	1·1	1·1
Turbot	0·8	0·5	1·0	1·2	1·2	1·1	1·0

It will be seen that cod, haddock, plaice and hake which in 1913 formed 66 per cent. of the total demersal fish accounted for 76 per cent. in 1919, 73 per cent. in 1920, 70 per cent. in 1921 and 1922 and 67 per cent. in 1923. The total quantity of these four fish in 1920 (7 million cwts.) was over 2 million cwts. more than in 1919, about 1½ million cwts. more than in 1913, and exceeded the previous record quantity of 1907 by about half a million cwts. In 1921 they totalled only 5½ million cwts., increasing to 6¼ million cwts. in 1922 but falling again to 5½ million cwts. in the following year. Taking the four kinds separately, haddock, which up to 1910 had held the premier position, regained that position in 1917 and held it up to 1922. The catch in 1920 (2,732,000 cwts.) was 600,000 cwts. heavier than in 1919, nearly 1,200,000 cwts. above the 1913 quantity and only 130,000 cwts. short of the record catch of 1907. In 1921 the total fell to 2,186,000 cwts. but in the following year increased to 2,498,000 cwts., falling to 2,037,000 cwts. in 1923. Cod stood first in the years 1910-16 and easily kept the second place until, in 1923, it regained the first. The quantity landed in 1920 (2,506,000 cwts.) showed an increase of over 60 per cent. as compared with the previous year but was nevertheless 140,000 cwts. less than in 1913 (the record year) and was also exceeded in 1914 and 1911. In 1921 there was a decline to 2,039,000 cwts. with, however, a recovery to 2,326,000 cwts. in the following year and a further decline to 2,045,000 cwts. in 1923. The catch of plaice had steadily declined from a maximum of 1,123,000 cwts. in 1904 to 699,000 cwts. in 1913. It dropped to a still lower point during the war years but in 1919 it rose almost to the 1913 level. With fishing in full swing again the landings in 1920, 909,000 cwts., showed a reversal of the pre-war tendency, being larger by 30 per cent. than in 1913, and the largest since 1911. In 1921 the total fell to only 656,000 cwts.—actually below the 1913 quantity; but in 1922, with 770,000 cwts., the 1913 catch was again surpassed, and in 1923, with 697,000 cwts., was almost equalled. Hake also had shown a steady decline during the years immediately preceding the outbreak of war, falling from 892,000 cwts. in 1909 to 621,000 cwts. in 1913; and during the war the catch fell off more noticeably than in any of the other important kinds, only 73,000 cwts. having been secured in 1917. In 1919, however, there was a very large increase to 478,000 cwts. and in 1920 a further large increase, the catch in that year (829,000 cwts.) being 73 per cent. heavier than in 1919, 33 per cent. above the 1913 level and only about 7 per cent. less than the record landing of 1909. In 1921 the quantity fell to just below the 1913 level, rising again in the following year to 19 per cent. above the catch of 1913 but falling again in 1923 to 9 per cent. above that point.

In Table E the landings of each kind of demersal fish in the years under review are expressed as percentages of the 1913 landings, the average for the years 1915-18 being also shown.

TABLE E.—QUANTITY OF EACH KIND OF DEMERSAL FISH EXPRESSED AS A PERCENTAGE OF THE QUANTITY LANDED IN 1913.

	Average 1915-18	1919.	1920.	1921.	1922.	1923.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Brill	41	113	150	127	121	102
Soles	34	68	122	124	152	130
Turbot	25	94	177	150	149	119
Total Prime Fish	31	85	149	136	146	122
Bream	15	34	56	55	60	71
Catfish	24	41	101	84	88	89
Coalfish	31	51	81	68	91	80
Cod	38	59	95	77	88	77
Conger Eels	58	78	108	126	117	102
Dabs	64	60	91	90	111	111
Dogfish	77	73	104	124	116	148
Dory	18	38	105	57	132	132
Flounders	58	36	84	103	94	73
Gurnards	43	73	78	70	66	74
Haddock	65	137	176	141	161	131
Hake	17	77	133	99	119	109
Halibut	16	30	68	82	124	145
Latchets	53	156	305	170	138	109
Lemon Soles	31	33	53	46	59	80
Ling	20	50	85	80	92	74
Megrims	25	62	91	83	75	65
Monks	39	46	70	74	74	73
Red Mullet	21	61	76	45	115	141
Plaice	36	95	130	94	110	100
Pollack	64	61	141	169	286	270
Skates and Rays	42	68	99	104	122	125
Torsk	11	8	38	61	74	100
Whiting	40	66	96	90	74	75
Witches	18	43	56	56	71	70
Total Demersal	40	76	114	94	108	97

It will be seen that, except in few cases, there is no uniformity in the annual changes in the landings of the various kinds. Halibut and skates are the only ones that consistently increased, while brill, soles, turbot, conger eels, latchets and megrims after increasing to a maximum have declined during the later years. The remaining kinds have fluctuated more or less considerably from year to year.

Since 1918, the quantity of brill has exceeded the 1913 figure in each year, the largest excess (50 per cent.) being in 1920. Soles have varied from 45,000 cwts. in 1919 to 101,000 cwts. in 1922, while turbot reached its highest point in 1920 with 114,000 cwts. Bream has remained continuously below the pre-war figure, ranging from 34 per cent. of 1913 in 1919 to 71 per cent. in 1923. Catfish just exceeded 1913 in 1920 but coalfish has always been below its pre-war standard. Conger eels reached the maximum in 1921 and have since declined to 102 per cent. of 1913 in the latest year under review. In 1922 and 1923, the quantity of dabs stood at 111 per cent. of 1913, but in 1919 it was less by as much as 30 per cent. Dogfish landings have remained above the 1913 level since 1919; in 1923 48 per cent. more was landed than in the earlier year. The quantity of dory is always very small but the percentage variation has been most marked, while flounders have varied from 2,000 cwts. in 1919 to 6,000 cwts. in 1921. Approximately three-quarters of the 1913 total for gurnards were landed each year. Halibut has increased progressively from year to year and in 1923 the landing was 154,000 cwts. (145 per cent. of 1913). Latchets show the largest percentage variation, having jumped from 3,000 cwts. in 1913 to 9,000 cwts. in 1920, and back again to 3,000 cwts. in 1923. The post-war landings of lemon soles, ling, megrims and monks are all below 1913, while red mullet is above only in 1922 and 1923. The increase in the landings of pollack has been very heavy, from 8,000 cwts. in 1919 to 37,000 cwts. in 1922 and 35,000 cwts. in 1923. Each year's landing of skates and rays has been greater than its predecessor, the 1923 quantity being 25 per cent. greater than 1913, while torsk, after falling to a very low ebb in 1919 has steadily increased and reached its pre-war magnitude in 1923; whiting and witches have both failed to attain to pre-war magnitude.

Considering the five years as a whole, every kind was landed in larger quantity in 1920 than in 1919 and, thereafter, 4 species (brill, turbot, latchets and megrims) have declined each year, 3 (halibut, skates and rays and torsk) have increased each year, while of the remaining 21 which fluctuated, 10 were above 1920 in the last year of the period and 11 below. From 1920, 8 kinds (brill, soles, turbot, congers, dogfish, haddock, latchets and pollack) have continued above the 1913 level and 10 (bream, coalfish, cod, gurnards, lemon soles, ling, megrims, monks, whiting and witches) have always been below.

Pelagic Fish.

Amongst pelagic fish herrings stand pre-eminent, normally contributing nine-tenths of the total. In 1913 the proportion was as

TABLE F.—QUANTITIES OF EACH KIND OF PELAGIC FISH AND PROPORTIONS PER CENT. OF EACH KIND TO THE TOTAL QUANTITIES LANDED.

	Herrings.		Mackerel.		Pilchards.		Sprats.	
	Thousands of cwts.	Per cent. of Total Pelagic.	Thousands of cwts.	Per cent. of Total Pelagic.	Thousands of cwts.	Per cent. of Total Pelagic.	Thousands of cwts.	Per cent. of Total Pelagic.
1913	7,313	94	345	4	52	1	75	1
Average 1915-18	1,128	83	134	10	20	2	71	5
1919	3,552	90	217	6	63	2	93	2
1920	4,637	91	328	6	36	1	75	2
1921	2,836	86	295	9	87	2·5	88	2·5
1922	2,677	85	270	9	91	3	110	3
1923	3,033	89	236	7	69	2	51	2

much as 94 per cent. but during the war period it fell to 83 per cent. becoming rather above the average again in 1919 and 1920 to fall to 86 per cent. in 1921 and to 85 per cent. in 1922. In 1923 the proportion rose to 89 per cent. Compared with 1913 the quantity was only about half in 1919, two-thirds in 1920 and less than two-fifths in 1921 and 1922 and just over two-fifths in 1923. The catch of 1920 would in all probability have been very much greater had there been any likelihood that the export trade could absorb it; during the latter part of the autumn season in East Anglia fishing was deliberately restricted. The three following seasons were very disappointing; in 1921 the herring were very scarce while in 1922 and 1923, although more plentiful, there were fewer boats to catch them.

Mackerel showed a greater recovery than herrings, the 1920 catch being but 5 per cent. below that of 1913. There was a progressive decline in the following years, however, the catch in 1923 being 32 per cent. less than in the pre-war year.

Pilchards were landed in considerably increased quantities in 1919 and after a bad set back in 1920 they bulked still greater in 1921 and 1922, the total in the latter year being the biggest for fourteen years and 75 per cent. greater than in 1913. In 1923 there was a fall to 34 per cent. above the pre-war year.

Sprats, which seem to have been less affected by war conditions than any other wet fish, exceeded the 1913 quantity by 24 per cent. in 1919, dropped to the 1913 level in 1920, increased by 17 per cent. the following year and in 1922 broke all records with a catch of 47 per cent. larger than in 1913. In 1923, however, the quantity fell by more than half and was 32 per cent. below the 1913 level.

Shell Fish.

The quantities of the principal kinds of shell-fish expressed as percentages of those of 1913 are shown in Table G hereunder.

Table G.—Quantities of the Principal Kinds of Shell Fish expressed as Percentages of the Quantity landed in 1913.

	Average 1915-18.	1919.	1920.	1921.	1922.	1923.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Crabs	70	73	78	88	93	108
Lobsters	65	98	113	138	111	122
Oysters	112	111	141	111	85	65
Shrimps	68	53	51	52	57	70
Cockles	63	66	73	68	65	52
Mussels	109	141	88	65	58	46

The fluctuations in the catch of shell-fish were much less marked than those of wet fish. Lobsters consistently improved to 38 per cent. above the 1913 level in 1921 and in spite of a set-back in 1922 the catch in 1923 was still 22 per cent. larger than in 1913. The number of oysters, which in 1920 was as much as 41 per cent. greater than in 1913 and in 1921 11 per cent. greater, fell in 1922 to 15 per cent. and in the following year to 35 per cent. below that of the pre-war year.

The other principal kinds, crabs, shrimps, cockles and mussels were well below the pre-war standard in each of the five years under review, except mussels in 1919 and crabs in 1923. In the case of crabs there has been a regular improvement each year to a catch of 8 per cent. above 1913 in 1923, but cockles have remained practically stationary at about two-thirds (with a fall to half in 1923) and shrimps at about half (increasing to two-thirds in 1923) of the 1913 catches, while mussels have shown a decline from 40 per cent. above 1913 in 1919 to 54 per cent. below in 1923.

METHODS OF CAPTURE.

The changes in the percentage amounts taken by the various types of vessels are shown in Table H.

TABLE H.—PERCENTAGE OF TOTAL WET FISH LANDED BY FIRST CLASS STEAM, MOTOR AND SAILING VESSELS AND BY OTHER METHODS OF FISHING.

	First Class Vessels.			Second and Third Class Vessels and from Shore.
	Steam.	Motor.	Sailing.	
	Per cent.	Per cent.	Per cent.	Per cent.
1911	89·8	0·1	6·1	3·5
1912	90·4	1·1	5·5	2·9
1913	90·9	1·4	4·7	2·9
1914	90·2	0·9	4·9	3·7
1915	84·6	2·6	4·9	6·9
1919	86·1	6·2	2·2	5·2
1920	91·9	3·4	1·5	3·0
1921	89·8	3·3	1·8	5·0
1922	91·0	3·3	1·9	3·8
1923	91·3	3·5	1·5	3·7

The most striking feature is the almost continuous decline in the proportion brought in by sailing vessels and the increase in that by motor vessels. The relatively large proportion taken by motor vessels in 1919 was at the expense of the steamers, some two hundred of the larger of which were still on war service.

Table I shows that from 95 to 97 per cent. of the total wet fish was caught by first class vessels, chiefly by trawling and drifting. By means of the Danish Seine 28,000 cwts. or less than 0.3 per cent. of the total were taken in 1921, but in the following year this method accounted for 296,000 cwts. equivalent to 2.4 per cent. of the total and in 1923 for 434,000 cwts. or 3.8 per cent. of the total.

The proportion taken by trawlers rose from 52 per cent. in 1913 to 68.5 per cent. in 1922 with a fall of 6 per cent. in the following year; nearly all was secured by steam, the proportion by sailing trawlers having diminished from 2.6 per cent. in 1913 to 1.4 per cent. in 1923. Motor trawling produced 17,000 cwts. in 1923, equal to a percentage of 0.2.

TABLE I.—QUANTITIES OF WET FISH CAUGHT BY EACH OF THE PRINCIPAL METHODS OF FISHING.

(a) = Quantities landed in thousands of cwts.
(b) = Percentage of total landings.

		1913.	1919.	1920.	1921.	1922.	1923.
First Class :							
Trawling :	Steam (a)	7,991	5,760	8,949	7.149	8,129	7 028
	(b)	*49·5*	*55·9*	*61·4*	*64·0*	*66·8*	*61·0*
	Motor (a)	1	27	27	25	20	17
	(b)	*0·0*	*0·3*	*0·2*	*0·2*	*0·2*	*0·2*
	Sailing (a)	418	219	205	193	177	159
	(b)	*2·6*	*2·1*	*1·4*	*1·7*	*1·5*	*1·4*
	Total (a)	8,410	6,006	9,181	7,367	8,326	7,204
	(b)	*52·1*	*58·3*	*63·0*	*65·9*	*68·5*	*62·6*
Lining :	Steam (a)	281	91	226	302	400	419
	(b)	*1·7*	*0·9*	*1·5*	*2·7*	*3·3*	*3·6*
	Motor (a)	15	42	22	45	42	44
	(b)	*0·1*	*0·4*	*0·2*	*0·4*	*0·3*	*0·4*
	Sailing (a)	19	—	—	—	—	—
	(b)	*0·1*	—	*0·0*	—	—	—
	Total (a)	315	133	248	347	442	463
	(b)	*1·9*	*1·3*	*1·7*	*3·1*	*3·6*	*4·0*
Danish Seine :	Steam (a)	—	—	—	25	284	425
	(b)	—	—	—	*0·2*	*2·3*	*3·7*
	Motor (a)	—	—	—	3	12	9
	(b)	—	—	—	*0·0*	*0·1*	*0·1*
	Total (a)	—	—	—	28	296	434
	(b)	—	—	—	*0·2*	*2·4*	*3·8*
Drifting :	Steam (a)	6,403	3,028	4,235	2,562	2,258	2,634
	(b)	*39·6*	*29·4*	*29·0*	*22·9*	*18·6*	*22·9*
	Motor (a)	209	570	449	291	315	335
	(b)	*1·3*	*5·5*	*3·1*	*2·6*	*2·6*	*2·9*
	Sailing (a)	307	2	—	—	– –	2
	(b)	*1·9*	*0·0*	*0·0*	—	*0·0*	*0·0*
	Total (a)	6,919	3,600	4,684	2,853	2,573	2,971
	(b)	*42·8*	*34·9*	*32·1*	*25·5*	*21·2*	*25·8*
Other methods and method not known	(a)	17	9	20	18	39	11
	(b)	*0·1*	*0·1*	*0·1*	*0·2*	*0·3*	*0·1*
Second and Third Class and from Shore	(a)	464	538	438	556	482	431
	(b)	*2·9*	*5·2*	*3·0*	*5·0*	*4·0*	*3·7*
Class of vessel or method of fishing not distinguished	(a)	27	22	13	6	—	—
	(b)	*0·2*	*0·2*	*0·1*	*0·1*	—	—

The catch by liners in 1919 was considerably below the pre-war year, but rapidly increased in 1920-23; in 1923 more than nine-tenths was secured by steam driven vessels, and motor driven contributed the remainder, first class liners depending solely on sails having ceased to fish.

Drifting being limited to the pelagic or surface fish and 1913 having been so exceptionally good a year for pelagic fishing, the proportion of the total wet fish secured by drifters was less in 1919-23 than in the earlier years. Here again the great bulk was secured by steam vessels but motors were more extensively used than for trawling or lining and have almost completely replaced the sailing drifters.

The proportions of each kind of pelagic fish caught by each of the principal methods are shown in Table J.

TABLE J.—PERCENTAGE OF HERRINGS, MACKEREL, PILCHARDS AND SPRATS CAUGHT BY EACH OF THE PRINCIPAL METHODS OF FISHING.

	1913.	1919.	1920.	1921.	1922.	1923.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Herrings : Drift	93	99	98	95	91	96
Trawl	7	0·6	2	5	8	4
Mackerel : Drift	81	79	74	76	70	76
Trawl	8	13	20	15	25	19
Pilchards : Drift	93	100	100	100	100	100
Seine	7	—	—	—	—	—
Sprats : Drift	46	23	21	20	19	24
Stow	43	43	60	64	59	46
Seine	8	34	17	13	11	23

In 1913 drift nets accounted for 93 per cent. of the herrings, practically the whole of the remaining 7 per cent. being taken in the trawl. By 1919 nearly all the herrings taken were by drift nets but the proportion so caught has since decreased, especially in 1922, when it had fallen to 91 per cent., the trawl landing as much as 8 per cent.

In the case of mackerel the increase in the proportion secured by the trawl is much more marked. In 1913 the proportion was 8 per cent., in 1919 13 per cent., in 1922 25 per cent., with a fall to 19 per cent. in the following year. Drifters secured 76 per cent. in 1923 as against 81 per cent. in 1913.

Pilchards were almost entirely taken by drift nets, the use of seine nets having been abandoned since 1916.

Stow nets for sprats have largely displaced the seines which were in evidence in 1918 and 1919. In 1923 nearly half of the total was caught in stow nets, about one-quarter by drift nets, and the remaining quarter by seines.

PLACE OF CAPTURE.

In Table K below the quantities of demersal fish taken from each region in 1913 and subsequent years are expressed as percentages of the total demersal in respect of which the place of capture was known (about 98 per cent. of the gross total).

TABLE K.—PROPORTION PER CENT. OF DEMERSAL FISH LANDED FROM EACH REGION.

Region.	1913.	1919.	1920.	1921.	1922.	1923.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Barents Sea (I)	1·5	—	0·0	0·3	2·3	3·8
North Sea (IV)	41·5	51·3	50·5	51·2	47·4	40·2
North of Scotland (V) ..	0·9	0·4	0·7	1·5	1·0	1·1
West of Scotland (VI) ...	7·6	5·7	4·3	7·1	9·0	8·0
Iceland (VII)	22·9	19·2	23·5	19·0	18·8	21·0
Faroe (VIII)	8·1	6·8	2·5	2·0	4·7	7·7
Rockall (IX)	0·7	0·3	0·4	0·5	0·4	0·4
West of Ireland (X) ...	1·8	0·5	1·2	1·5	0·9	1·7
Irish Sea (XI)	2·8	2·6	1·9	2·5	2·4	2·8
South of Ireland (XII) ...	7·6	8·2	10·8	9·8	9·0	8·2
Bristol Channel (XIII) ...	1·3	1·4	1·3	1·3	1·4	1·6
English Channel (XIV)...	2·4	3·6	2·8	3·0	2·2	2·6
Biscay (XV and XVI) ...	0·2	0·0	0·0	0·1	0·0	0·1
Portugal and Morocco (XVII and XVIII)	0·7	0·0	0·1	0·2	0·5	0·8

The chief change revealed by these figures appears to be an increase as compared with 1913 in the proportion secured from the home regions during the first three years of the period with a tendency to return to the 1913 position during the last two years. Thus, taking the regions adjoining the coasts of England and Wales (North Sea, English Channel, Bristol Channel and Irish Sea) the proportion rose from 48 per cent. in 1913 to 59 per cent. in 1919, was 57 per cent. in 1920 and 58 per cent. in 1921, falling to 53 per cent. in 1922 and to 47 per cent. in 1923. If the above group be extended to embrace all regions contiguous to the British Isles by adding North and West of Scotland and South and West of Ireland, a very similar change is observed; the proportion rose from 66 per cent. in 1913 to 74 per cent. in 1919 and 1920 with a further rise to 78 per cent. in 1921 followed by a fall to 73 per cent. in the following year and a further fall to 66 per cent. in 1923.

TABLE L.—QUANTITY OF DEMERSAL FISH LANDED FROM EACH REGION IN 1913 AND QUANTITIES LANDED IN 1919-23 EXPRESSED AS PERCENTAGES THEREOF.

Region.	1913.	1919.	1920.	1921.	1922.	1923.
	Thousands of Cwts.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Barents Sea (I)	120	—	4	18	167	247
North Sea (IV)	3,386	95	139	117	123	94
North of Scotland (V) ...	76	32	81	153	118	170
West of Scotland (VI) ...	620	57	64	88	127	102
Iceland (VII)	1,868	64	117	79	88	89
Faroe (VIII)	658	65	35	24	63	92
Rockall (IX)	57	34	65	71	67	54
West of Ireland (X) ...	149	20	77	79	52	93
Irish Sea (XI)	226	72	78	85	94	98
South of Ireland (XII) ...	623	83	161	121	127	104
Bristol Channel (XIII) ...	103	83	121	96	117	125
English Channel (XIV)	193	118	134	123	100	106
Biscay (XV and XVI) ...	15	6	11	37	21	28
Portugal and Morocco (XVII and XVIII)	55	1	13	23	85	109

In Table L the quantities from each region are shown as percentages of 1913, and it is at once evident that with the exception of Iceland in 1920 and Barents Sea in 1922, all regions that yielded greater quantities of fish in 1919, 1920 or 1921, as compared with 1913, were adjacent to British coasts. The English Channel was well above 1913 in the first three years and the North Sea and South of Ireland in 1920 and 1921. On the other hand, Faroe, Rockall, Biscay, Portugal and Morocco and Barents Sea were distinctly below in all three years and Iceland in two of the three.

In 1923 the proportion from the North Sea fell below the 1913 level and other home regions (N. and W. of Scotland and S. of Ireland) also showed a fall while there were large increases in the contributions from certain of the distant regions, *e.g.*, Barents Sea, Faroe, Portugal and Morocco.

Tables M and N below give similar particulars for the pelagic group. All is caught in the regions adjoining the British coasts and practically all off the coasts of England and Wales. The most noticeable change as compared with 1913 is the almost continual decline in the proportion from the North Sea—from 92 per cent. in the pre-war year to 79 per cent. in 1923. The Irish Sea also contributed a smaller proportion, 0.5 per cent. in 1923 as against 2.1 per cent. in 1913. These decreases were balanced by increases in all the other regions, most pronounced in the case of

TABLE M.—PROPORTION PER CENT. OF PELAGIC FISH LANDED FROM EACH REGION.

Region.	1913.	1919.	1920.	1921.	1922.	1923.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
North Sea (IV)	92·15	88·78	89.44	81·54	77·70	79·34
North of Scotland (V) ...	0·00	0·00	0·00	0·02	0·01	0·03
West of Scotland (VI) ...	0·04	0·03	0·29	0·13	1·08	0·42
West of Ireland (X) ...	0·00	—	0·01	0·02	0·01	0·02
Irish Sea (XI)	2·14	0·37	0·14	0.32	0·47	0·50
South of Ireland (XII) ..	1·93	0·61	1·52	5·95	7·55	4·21
Bristol Channel (XIII) ...	0·88	4·20	4·03	5·32	4·10	5·06
English Channel (XIV) ...	2·86	6·01	4·57	6·70	9·08	10·42

TABLE N.—QUANTITY OF PELAGIC FISH LANDED FROM EACH REGION IN 1913 AND QUANTITIES LANDED IN 1919-23 EXPRESSED AS PERCENTAGES THEREOF.

Region.	1913.	1919.	1920.	1921.	1922.	1923.
	Cwts.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
North Sea (IV) ...	7,167,154	49	63	38	34	37
North of Scotland (V)	100	47	188	603	286	1,030
West of Scotland (VI)...	3,416	39	429	122	967	417
West of Ireland (X) ...	92	—	509	846	298	803
Irish Sea (XI)	166,389	9	4	6	9	10
South of Ireland (XII)	150,408	16	51	131	158	95
Bristol Channel (XIII)	68,223	242	300	258	189	251
English Channel (XIV)	222,121	106	104	100	129	159

the English Channel and the South of Ireland. The former contributed 10.4 per cent. in 1923 as against 2.9 per cent. in 1913 and the latter 4.2 per cent. as against 1.9 per cent. The rise in the South of Ireland proportion was due to an increased use of the trawl.

Comparing the quantities with those secured in 1913 it will be seen from Table N that the North Sea catch was about half in 1919, about two-thirds in 1920 and only about one-third in the last three years. The relative drop in the Irish Sea catch is still more remarkable, being in 1920 only 4 per cent. of the 1913 catch and never exceeding 10 per cent. The North and West of Scotland and West of Ireland, though showing very large proportionate increases, are nevertheless unimportant in view of the small quantities concerned. As regards the three remaining regions, the quantity from the English Channel never fell below the 1913 level; the Bristol Channel contribution was from two to three times as large, while the catch from the South of Ireland has varied from 80 per cent. below to 60 per cent. above the 1913 quantity.

CHAPTER II.—FISHERMEN AND FISHING VESSELS.

As hitherto, statistics of men and vessels engaged in sea fishing have been supplied to the Ministry by the Registrar-General of Shipping and Seamen, and have been included in the four issues of _Sea Fisheries—Statistical Tables_* covering the years under review.

FISHERMEN.

Owing to the abnormal conditions, the usual statistics of men and boys engaged in sea fishing could not be satisfactorily obtained for the period of the war, and the last year, prior to 1919, for which they are available is 1914. The figures for that year and for 1919 to 1923 for England and Wales (which, as throughout the Ministry's own fishery statistics, includes the Isle of Man) were :—

	1914.	1919.	1920.	1921.	1922.	1923.
Regularly Employed :						
In Trawling (except for Shrimps)	20,278	20,559	20,653	19,201	18,658	19,297
In other Modes	17,105	14,413	14,191	14,162	13,852	13,638
Total	37,383	34,972	34,844	33,363	32,510	32,935
Occasionally Employed :						
In Trawling (except for Shrimps)	1,580	3,395	1,688	1,552	1,502	1,566
In other Modes	5,661	4,188	4,585	3,662	3,540	3,644
Total	7,241	7,583	6,273	5,214	5,042	5,210
Total Employed :						
In Trawling (except for Shrimps)	21,858	23,954	22,341	20,753	20,160	20,863
In other Modes	22,766	18,601	18,776	17,824	17,392	17,282
Total	44,624	42,555	41,117	38,577	37,552	38,145

In 1919 there were 2,069 fewer men and boys employed than in 1914, and there was a further decrease in each of the following three years, the number in 1922 being 7,062 less than in 1914. In 1923 there was a slight increase, the deficiency as compared with the first war year being reduced to 6,479.

The proportion of men regularly employed, which was 83 per cent. in 1914, was 82 per cent. in 1919, 85 per cent. in 1920 and 87 per cent. each year since. Of the total, regular and occasional, 49 per cent. were employed in trawling in 1914, 56 per cent. in 1919, 54 per cent. in 1920-22 and 55 per cent. in 1923.

Including Scotland, Ireland and the Channel Islands, the Registrar-General's estimate for the United Kingdom as a whole shows a decrease of 15,373 in 1922 (the latest year available) as compared with 1914—from 96,847 to 81,474. The figures for 1919, 1920 and 1921 were respectively 86,698, 87,960 and 83,468.

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* For particulars see cover.

FISHING VESSELS.

The statistics of fishing vessels relate to the vessels on the registers on the 31st December each year.

During the years preceding the war, the total number of registered fishing vessels had steadily declined each year from 9,799 in 1909 to 9,315 in 1914. From that year there was a steady increase until 1918 when 10,032, the largest number during the present century, was reached. Thereafter there has been a fall each year, the number in 1923 being 8,956—1,076 less than in the maximum year (1918) and 359 less than in the previous minimum year (1914).

(a) *First Class Vessels.*

The first class* vessels taken alone show a decline each year from 3,724 in 1908 to 2,962 in 1918—the lowest point during the past quarter of a century. In 1919 and 1920 there were increases—to 3,172 in the later year—but during the last three years the number again declined, the 1923 figure (2,975) being only 13 above the minimum of 1918.

The number of first class steamers on the register at the end of 1914 was 2,051, which number, chiefly owing to losses by enemy action, fell during each of the war years to a minimum of 1,859 in 1918. In 1919 there was an increase to 1,950, with a further increase to 2,147 in the following year, but in 1921 there was a slight reduction to 2,122, which was repeated in the next two years, the number in 1923 standing at 2,032. Sailing vessels showed a more marked annual decline during the war years—from 1,266 in 1914 to 721 in 1918—and this decline has continued since, the number in 1923 being reduced to 489. In the case of motor-driven vessels, however, the number has steadily increased each year to 1921—it was 207 in 1914 and 470 in 1921—and this partly accounts for the decrease in the sailing vessels, a number of which have been re-fitted as motor vessels. In 1922 and again in 1923, there was a slight set-back to 454 in the later year.

The number of first class steam, motor and sailing vessels, with the percentage each kind formed of the total number of first class vessels, in 1914 and 1918-23 were :—

	Steam.		Motor.		Sailing.		Total No.
	No.	Per cent. of Total.	No.	Per cent. of Total.	No.	Per cent. of Total.	
1914	2,051	58	207	6	1,266	36	3.524
1918	1.859	63	382	13	721	24	2,962
1919	1,950	65	432	14	638	21	3,020
1920	2.147	68	466	15	559	17	3,172
1921	2,122	68	471	15	532	17	3.125
1922	2,089	68	468	15	514	17	3,071
1923	2,032	68	454	15	489	17	2,975

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* The *First Class* includes all steam and motor boats of 15 tons gross tonnage and upwards and all sailing boats of 15 tons net tonnage and upwards.

The *Second Class* includes all steam and motor boats of less than 15 tons gross tonnage and other vessels of less than 15 tons net tonnage or of 18 feet keel and upwards.

The *Third Class* includes all boats (other than steam or motor) under 18 feet keel except unregistered rowing boats.

In 1919 almost, and in 1920-23 more than two-thirds of the first class vessels were steam propelled, and while the proportions of steam and motor-driven show considerable increases as compared with 1914, the proportion held by sailing vessels has been very much less—in the last four years less than half that of 1914.

The numbers, total tonnage and average tonnage of first class vessels engaged in fishing solely by trawl, lines or drift nets respectively, distinguishing also the method of propulsion, are given in Table O hereunder. The numbers engaged on war service are also shown, except for 1914, when such vessels were not separately distinguished, but shown under their usual method of fishing.

TABLE O.—NUMBER AND AVERAGE TONNAGE OF FIRST CLASS VESSELS ENGAGED SOLELY IN TRAWLING OR LINING OR DRIFTING* WITH THE NUMBER EMPLOYED ON WAR SERVICE, 1914 AND 1918-23.

	Trawlers.		Liners.		Drifters.*		War Service.	
	No.	Average tonnage.	No.	Average tonnage.	No.	Average tonnage.	No.	Average tonnage.
Steam—								
1914	1,369	207	58	176	565	81	—	—
1918	323	180	7	130	89	64	1,414	181
1919	1,228	215	22	106	406	80	202	158
1920	1 537	221	30	145	402	81	6	119
1921	1 378	218	46	133	405	84	1	205
1922	1,358	215	46	126	378	83	—	—
1923	1,359	217	52	157	404	85	—	—
Motor—								
1914	10	18	6	19	58	24	—	—
1918	25	28	22	21	77	27	21	35
1919	49	25	68	23	86	25	1	17
1920	78	26	51	21	72	24	—	—
1921	78	27	37	22	64	24	—	—
1922	70	30	36	19	75	28	—	—
1923	74	27	31	23	80	27	—	—
Sailing—								
1914	798	35	24	39	152	27	—	—
1918	385	31	5	18	28	27	10	49
1919	414	30	6	31	21	24	2	59
1920	380	30	4	26	10	24	—	—
1921	370	31	—	—	10	24	—	—
1922	359	31	1	22	6	23	—	—
1923	346	31	1	17	5	23	—	—
Total—								
1914	2,177	—	88	—	775	—	—	—
1918	733	—	34	—	194	—	1,445	—
1919	1,691	—	96	—	513	—	205	—
1920	1,995	—	85	—	484	—	6	—
1921	1,826	—	83	—	479	—	1	—
1922	1,787	—	83	—	459	—	—	—
1923	1,779	—	84	—	489	—	—	—

NOTE.—The tonnages for steam and motor are gross; for sailing, net.

* The figures for drifters for 1921-3 include some Danish seiners.

At the end of 1918 as many as 1,445 or 49 per cent. of the total first class vessels were engaged on war service, but by the end of the following year this number had fallen to 205 (about 7 per cent.), and by the end of 1920 the number so employed was negligible. Steam vessels suffered much more both in actual number and proportionately than either motor or sailing, of which the number taken was small.

In Table P below, the percentages of first class steam, motor and sailing vessels engaged in the various methods are given for 1914 and 1920-23 (the actual numbers are given for 11 years in Table 26 of *Sea Fisheries—Statistical Tables*, 1923*). The figures for 1919 are omitted as about 10 per cent. of the steamers were still on war service.

TABLE P.—PROPORTION PER CENT. OF FIRST CLASS STEAM, MOTOR AND SAILING VESSELS ENGAGED IN EACH METHOD OF FISHING, 1914 AND 1920-23.

	Trawl.	Drift.	Lines.	Trawl and Lines.	Trawl and Drift	Trawl and other methods.	Lines and Drift.	Dredges.	Other methods.	Not employed.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Steam—										
1914	67	28	3	—	—	—	1	—	—	1
1920	72	19	1	—	2	—	3	—	1	2
1921	65	19	2	—	1	—	3	—	3	7
1922	65	18	2	—	—	—	3	—	5	7
1923	67	20	3	—	—	—	2	—	3	5
Motor—										
1914	5	28	3	4	2	2	49	1	4	2
1920	17	15	11	7	4	4	29	1	4	8
1921	17	14	8	5	3	4	31	1	10	7
1922	15	16	8	5	2	5	30	1	10	8
1923	16	18	7	4	3	5	28	1	10	8
Sailing—										
1914	63	12	2	2	1	2	3	5	5	5
1920	68	2	1	—	—	4	1	6	10	8
1921	70	2	—	1	—	3	1	7	11	5
1922	70	1	—	—	—	4	1	8	10	6
1923	71	1	—	—	—	3	1	9	9	6

Dealing with the steam vessels first, the number of trawlers using the trawl only increased from 1,369 (67 per cent. of the first class steam vessels) in 1914 to 1,537 (72 per cent.) in 1920, thereafter declining to 1,359 or 67 per cent. in 1923. Drifters and liners on the other hand both showed a decrease in 1920—from 565 (28 per cent.) to 402 (19 per cent.) in the case of the former, and from 58 (3 per cent.) to 30 (1 per cent.) in the case of the latter. In the following years liners increased to 52 (3 per cent.) in 1923, while drifters, falling to 378 in 1922 increased to the 1920 level in 1923. In 1920 there was a considerable increase in the number of vessels combining trawling and drifting or drifting and lining, such vessels numbering 33 (2 per cent.) in 1914 as against 119 (5 per cent.) in 1920; but thereafter there was a decrease each year to 47 (2 per cent.) in 1923. Of the two combinations lining and drifting was the more frequent. During the last three years considerably more steamers were returned as unemployed than formerly. In 1914 and 1919 there were only 14, but in 1921 as many as 152 with 136 in 1922 and 100 in 1923.

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* For particulars of these Tables see cover.

In the case of steamers, 92 per cent. in 1920 were trawlers, drifters or liners using only one method of fishing; the corresponding proportion for motors was, however, only 43 per cent. (it was smaller still in 1914, only 36 per cent.), 44 per cent. being equipped for more than one method, and these proportions have changed little since. The proportion of motors using the trawl only increased from 5 per cent. in 1914 to 11 per cent. in 1919, and was 16 per cent. in 1923, and liners showed an even larger increase in 1919 (from 3 to 16 per cent.), but the proportion has since dropped to 7 per cent. (in 1923). The proportion of drifters has only averaged about half the 1914 proportion (28 per cent.). Of the combined methods, lining and drifting, by far the most important, showed a considerable relative decline, the proportion being 49 per cent. in 1914 and 28 per cent. in 1923; but the vogue of the other combinations has increased. Motor vessels on the register as fishing vessels, but not engaged in fishing during the year, formed 2 per cent. of the total in 1914, 4 per cent. in 1919, and 7 or 8 per cent. in the following year.

Among the sailing vessels, trawlers limited to trawling are by far the most important class; the proportion to the total sailing vessels increased from 63 per cent. in 1914 to 71 per cent. in 1923, although the actual numbers, in common with all other classes of sailing vessels, show a very large decrease—from 798 in 1914 to 346 in 1923. The proportionate increase in the trawlers was chiefly due to the very large decrease in the drifters—from 12 per cent. in 1914 to 1 per cent. in 1923; this class suffered more heavily than any other class of sailing vessels, the actual numbers falling from 152 in 1914 to 5 in 1923. Sailing vessels using more than one method are relatively few; the chief change since 1914 would appear to be an increase in the proportion combining trawling with other methods.

From an examination of the average tonnages of the vessels engaged in the three principal methods given in Table O it would appear that steam trawlers were generally somewhat larger than in 1914, averaging 217 tons gross (in 1923) as against 207; liners smaller (176 tons gross in 1914 as against 157 in 1923) and drifters about the same (80-85 tons gross). Motor trawlers and liners both tended to be larger, the former averaging 18 tons gross in 1914 and 27 in 1923, and the latter 19 tons gross in 1914 and 23 in 1923. Like the steam drifters, the motor drifters show little change. As regards the sailing vessels it would seem that those fitted with motors or withdrawn from fishing were the larger vessels, all three types of sailing vessels showing a smaller average tonnage in all the years under review than in 1914; the average for trawlers fell from 35 tons net to 30, in 1923, for liners from 39 tons net to 17 and for drifters from 27 tons net to 23.

In Table Q below, is given the number of first class boats registered at each of the principal ports in 1914 and 1923; the 12 ports distinguished account for four-fifths of the total first class boats.

TABLE Q.—NUMBER OF FIRST CLASS FISHING BOATS ON THE REGISTER ON THE 31ST DECEMBER, 1914 AND 1923, AT THE PRINCIPAL PORTS OF REGISTRATION.

	Steam.		Motor.		Sailing.		Total.	
	1914.	1923.	1914.	1923.	1914.	1923.	1914.	1923.
Grimsby	641	622	8	46	22	3	671	671
Lowestoft	329	335	1	13	265	138	595	486
Hull	396	314	3	15	17	1	416	330
Yarmouth	196	169	1	1	4	—	201	170
Fleetwood	94	159	—	1	29	9	123	169
Brixham	1	1	7	22	193	89	201	112
Berwick	24	20	51	44	40	2	115	66
Ramsgate	—	22	1	16	152	27	153	65
North Shields	102	60	—	1	1	—	103	61
Scarborough	26	43	5	17	26	—	57	60
Milford	62	40	2	2	14	6	78	48
London	17	82	—	10	40	35	57	127

While it does not always happen that vessels fish from their port of registration yet, with a few exceptions, it may be taken that, at registration ports which are also active fishing ports, the number of boats on the register affords an indication of the number working from the port.

As regards methods employed, in 1923 76 per cent. of the Grimsby vessels were steam trawlers as against 89 per cent. in 1914 and, whereas in the earlier year the balance consisted almost entirely of liners, the proportion of that type had fallen in 1923 to 7 per cent. of the total, with an increase in drifters to 5 per cent. and of " other methods " to 11 per cent. There was, relatively, a considerable increase in motor vessels at the expense of both steam and sailing. At Hull, in both years, almost all the boats were steamers and almost all the steamers trawlers. At Lowestoft drifters were the chief steam vessels, although steam trawlers have increased considerably since 1914. All the sailing vessels remaining in 1923 (138) were trawlers; in 1914, 251 of a total of 265 were trawlers. In 1914 Yarmouth was practically limited to steam drifters, which numbered 194; in 1923 the number had fallen to 114, but there were in addition 30 steam trawlers. At Fleetwood in both 1914 and 1923 all the steam and sailing vessels were trawlers; the steam increased from 94 to 150, with a decrease in sailing of from 29 to 9; there were no motors in 1914 and only one in 1923. At Brixham in 1914 the boats were almost exclusively sailing, which numbered 193 as against 1 steam and 7 motor; in 1923 there were 89 sailing, with 1 steam and an increase to 22 in motor boats. In both years practically all the boats were trawlers.

(b) *Second and Third Class Vessels.*

Unlike the first class, both second and third class boats increased in number each year during the war period 1914-18, with a falling off in 1919 and the subsequent years. Comparing 1923 with 1914 it will be seen from Table R that there were on the register in the later year 216 (or 6 per cent.) more second class and 26 (or 1 per cent.) fewer third class boats. The average size of both classes was smaller in 1923 than in 1914.

TABLE R.—NUMBER, NET TONNAGE AND AVERAGE TONNAGE OF SECOND AND THIRD CLASS FISHING BOATS, 1914 AND 1918-23.

	Second Class.			Third Class.		
	No.	Net Tonnage.	Average Tonnage.	No.	Net Tonnage.	Average Tonnage.
1914	3,848	24,022	6·2	1,943	3,437	1·8
1918	4,412	25,501	5·8	2,658	4,210	1·6
1919	4,348	25,108	5·8	2,477	3,948	1·6
1920	4,199	24,208	5·8	2,213	3,511	1·6
1921	4,145	23,655	5·7	2,114	3,359	1·6
1922	4,110	23,267	5·7	2,054	3,257	1·6
1923	4,064	22.970	5·7	1,917	3,047	1·6

An analysis of the methods of fishing employed by second class boats of each of the three methods of propulsion is given in Table S.

During the five years, steam vessels show little change and are numerically unimportant. Motors increased from 1,461 in 1919 to 2,056 in 1923. All methods except drifting, which varied little, shared in the increase. The trawling fleet grew from 183 to 255, the trawlers using also other methods from 349 to 406 and the motors combining lining and drifting from 348 to 441; but the largest proportional change was in "other methods," from 101 to 434. Sailing vessels decreased each year from 2,870 in the first year of the period to 1,995 in the last. All methods reflect the decline, but liners most.

The changes in methods since 1914 are much more marked.

Taking the latest year, 1923, motors were more than six times as numerous—323 in 1914 compared with 2,056 in 1923; while sailing, which numbered 3,514 (91 per cent. of the total) in 1914, dropped to 1,995 (49 per cent.). The number of motor boats showed a large increase for each of the methods of fishing distinguished. Trawlers using also other methods and liners equipped also with drift nets were the most numerous types in 1914, numbering respectively 61 and 70 (41 per cent. of the total); in 1923 they numbered 406 and 441 (also 41 per cent.). Of the boats using the trawl, drift nets or lines only, drifters were the most numerous in 1914 and trawlers the least so; but in 1923 drifters occupied the third position, trawlers the second, and liners the first. These three types numbered 121 (37 per cent. of the total) in 1914 and 674 (33 per cent.) in the later year. The methods so far mentioned accounted for 78 per cent. (in 1914) and 74 per cent. in 1923, miscellaneous methods being relatively more important in 1923.

TABLE S.—NUMBER AND NATURE OF EMPLOYMENT OF SECOND CLASS FISHING BOATS ON THE REGISTER ON THE 31ST DECEMBER, 1914 AND 1919-1923.

	Trawl.	Drift.	Lines.	Dredges.	Trawl & other methods.	Lines & Drift.	Other methods.	Not employed.	Total.
Steam—									
1914	8	2	—	1	—	—	—	—	11
1919	2	—	2	—	6	2	3	2	17
1920	—	—	1	—	4	2	2	2	11
1921	2	—	1	—	4	3	3	1	14
1922	2	—	1	—	4	1	3	2	13
1923	4	—	1	—	2	1	4	1	13
Motor—									
1914	20	60	41	9	61	70	56	6	323
1919	183	154	240	17	349	348	101	69	1,461
1920	196	143	346	19	353	417	101	53	1,628
1921	229	144	332	15	331	501	200	56	1.808
1922	212	145	285	19	379	411	407	63	1.921
1923	255	149	270	23	406	441	434	78	2,056
Sailing—									
1914	499	414	568	250	313	1,303		167	3.514
1919	491	162	605	157	382	499	438	136	2.870
1920	442	141	561	144	370	392	386	124	2,560
1921	401	119	500	141	313	381	352	116	2,323
1922	383	100	368	111	308	254	561	91	2,176
1923	347	110	322	84	299	217	499	117	1,995

The general decline in boats relying entirely on sails was most marked in the drifters, which numbered only 110 compared with 414 in 1914, and formed only 6 per cent. of the total as against 12 per cent. in 1914. The proportion of trawlers increased from 14 per cent. to 17 per cent., that of liners was 16 per cent. in both years, while dredges, which are quite unimportant among steam or motor boats of either first or second class, formed 7 per cent. in 1914 with a fall to 4 per cent. in 1923, the actual numbers in all cases showing considerable reductions. Miscellaneous methods including boats combining lining and drifting decreased from 1,303 to 716, or from 37 per cent. of the total to 36 per cent.

FISHING CASUALTIES DURING THE YEARS 1919-1922.

The followng Tables show the casualties during the post-war years up to and including 1922 together with the average for the pre-war quinquennium. These figures are on a somewhat different basis from those for the war period inasmuch as casualties in the rivers and harbours of the United Kingdom are included, and they relate to vessels registered under Part IV of the Merchant Shipping Act, 1894, *i.e.*, to all fishing vessels on the Register, whereas previous figures were limited to vessels registered under Part I of that Act.

A.—Loss of Life.

NUMBER OF DEATHS AMONG THE CREWS OF FISHING VESSELS IN THE CALENDAR YEARS 1919-22, WITH THE AVERAGE FOR THE FIVE YEARS ENDING 30TH JUNE, 1914.

(a) = Steam Vessels. (b) = Sailing Vessels.

		Shipping Casualty.	Accident.	Disease, Homicide and Suicide.	Total.	
Average, 1910-14	(a)	95	56	22	173	267
	(b)	61	26	7	94	
1919	(a)	28	23	15	66	73
	(b)	5	1	1	7	
1920	(a)	39	50	20	109	122
	(b)	11	2	—	13	
1921	(a)	45	36	10	91	112
	(b)	18	3	—	21	
1922	(a)	35	31	12	78	94
	(b)	15	1	—	16	

B.—Loss of Vessels.

CASUALTIES, WHETHER AT SEA OR IN RIVER OR HARBOUR, TO FISHING VESSELS REGISTERED IN THE UNITED KINGDOM DURING THE CALENDAR YEARS 1919-22, WITH THE AVERAGE FOR THE FIVE YEARS ENDING 30TH JUNE, 1914.

(a) = Steam Vessels. (b) = Sailing Vessels.

		Average 1910-14.	1919.	1920.	1921.	1922.
		No.	No.	No.	No.	No.
Total Losses	(a)	34	29	75	62	53
	(b)	67	9	13	9	10
Serious Casualties	(a)	245	71	97	63	55
	(b)	104	12	13	13	5
Total	(a)	279	100	172	125	108
	(b)	171	21	26	22	15
With loss of life	(a)	13	6	9	12	5
	(b)	26	3	6	6	6
Tonnage of Vessels Totally Lost.		Tons Net.	Tons Gross.	Tons Gross.	Tons Gross.	Tons Gross.
Founderings	(a)	165	43	554	1,278	1,295
	(b)	111	3	7	26	2
Strandings	(a)	850	838	3,184	2,718	2,610
	(b)	723	152	200	—	89
Collisions	(a)	394	414	1,114	1,204	536
	(b)	293	48	53	8	14
Missing Vessels	(a)	292	302	207	—	—
	(b)	116	—	—	2	102
Other Casualties	(a)	50	278	992	751	519
	(b)	99	77	1	1	—
Total	(a)	1,751	1.875	6,051	5,951	4,960
	(b)	1,342	280	261	37	207

CHAPTER III.—THE HERRING FISHERY AT YARMOUTH AND LOWESTOFT.

THE SEASON OF 1919.

The herring fishermen, when they were demobilised in the early part of 1919, were confronted with a most dismal outlook. Coal, nets and materials of all kinds had appreciated greatly in value and, at the same time, there appeared to be no prospect of finding remunerative markets for the catches.

A peculiarity of the British herring industry is that, unlike other branches of the fishing industry, a very small proportion of its product is consumed at home. As much as 80 per cent. is cured in salt and exported in barrels to the countries of Central Europe, and in particular to Russia, Poland and Germany. Russia was closed and the economic conditions in Poland and Germany were such as to render trade upon normal lines an impossibility. It was obvious that if any trade was to be done with the two latter countries, it would have to be upon terms of such long credit as practically to preclude business being done by the industry unaided. Before the war, the trade in exported herrings was practically a ready money business. The curers had, of course, to provide a certain amount of money for initial expenses in hiring the women who do the curing and also the coopers, in providing salt and barrels, and for the purchase of herrings, but as soon as the herrings were cured they were exported, and in a very short time the curers received the proceeds, which they were able to turn over for the purchase and curing of more herrings. As a result, the capital invested in the industry was only large enough to finance curing operations for a comparatively short time, and it was obvious that if that capital was locked up for a long period in the form of credits to foreign countries, the industry would come to a dead stop unless financial assistance could be found from the outside.

Another factor in the case was that if there were no curing there would be very little herring available for home consumption. The conditions of the fishing are such that the fishermen cannot regulate their catches, and however much the fishing fleets are reduced there must always be times when the amount caught is greater than the home market can absorb. This surplus would be wasted unless the curers were there to take it. The fishermen could not afford to go to sea and run the risk of using their coal and gear in catching herring for which they would obtain no remuneration. In addition, the cost of living was very high and the fishermen were reluctant to go to sea unless they were guaranteed a certain return for their labour.

In these circumstances, the Government was approached in 1919 before the commencement of the Scottish summer fishing by representatives of the fishermen and others interested in the herring fishing, with a view to a subsidy being obtained in respect of the Scottish fishery which would enable a guarantee of a minimum price to be given to the fishermen for the fish they caught. After considerable negotiation, it was agreed to guarantee a price of 35s. per cran to the fishermen for a maximum amount of 400,000 barrels, and a scheme was drawn up for this purpose, whereby the Government purchased at the guaranteed price all sound cured herrings offered to them up to a total of 400,000 barrels. This scheme was not entirely successful, mainly because it did not take the form of a direct guarantee to the fishermen. What was done was to guarantee to the curers that they should be paid for the cured article a price which would cover the cost of curing and the price they actually paid to the fishermen for the herring, provided that the price paid did not exceed 35s. per cran. If the amount paid for the herring was less than 35s. per cran, the amount paid to the curer was reduced proportionately.

In effect, there was a maximum price to the fishermen but no minimum, it being considered unnecessary to provide a minimum as it was thought that the curers would be quite willing to pay the full 35s. per cran to the fishermen. In practice, however, it worked out differently, and in times of heavy catches the prices dropped and the curers paid for the herring considerably less than 35s. On the average, the fishermen during the Scottish fishing received only 29s. 3d. per cran and a very large proportion of the boats fished at a loss. The amount of herring purchased by the Government was about 229,000 barrels.

After the conclusion of the Scottish fishery, the Government were, as was inevitable, again approached with a petition for a guarantee for the great Autumn herring fishery at Yarmouth and Lowestoft, and this time they were asked that the guaranteed price should be 45s. per cran because the cost of living and the price of coal and material had increased during the summer and 35s. per cran was inadequate to provide for working expenses and a living wage for the fishermen. The financial obstacles to a renewal of the guarantee were serious, but ultimately it was decided to guarantee 45s. per cran for 600,000 barrels, and it was at the same time intimated to the fishermen that no further guarantees would be given and that for future years they must rely on their own resources.

Profiting by the experience of the Scottish fishery, the scheme of guarantee was arranged on entirely different lines and took the shape of a guarantee to both fishermen and curers. The form of it was that the curers were guaranteed a price of 66s. 6d. per barrel, which was sufficient to cover the cost of herring at 45s. per cran and the cost of the curing, but no curer was allowed to take advantage of the guarantee unless he could show that he had paid 45s. per cran, not only for the herring which he sold to the Government under the guarantee but also for all herring which he had purchased for curing. To assist in controlling the scheme, recourse was had to the Defence of the Realm Act and a Regulation was made prohibiting any person from engaging in curing without a licence, a condition of such licence being that the holder should pay 45s. per cran for all herring purchased for curing. The administration of the guarantee was placed in the hands of a body styled the " Herring Fisheries Executive Committee "; it consisted of representatives nominated by all branches of the industry and presided over by a nominee of the Government. The Government also appointed a Secretary.

The fishing commenced under the most difficult circumstances, as the national railway strike had only just come to an end and there was a shortage of coal, salt and other materials, and in addition many of the Scottish girls and coopers were detained at railway stations on their way from Scotland. Prompt steps were taken with regard to coal, and some of the powers of the Coal Mines Department were delegated to the Committee, which enabled it to ration the limited supplies available fairly and equally between all the vessels. With the help of the Ministry of Transport, salt wagons which were stranded at railway sidings all over the country were collected and forwarded to Yarmouth and Lowestoft and in addition, the assistance of the Ministry of Shipping was evoked in order to provide tonnage for the carriage of salt. As the railway position became more normal, the various work-people arrived and the scheme was able to commence.

From the beginning it was realised that one serious difficulty had to be provided against, viz., that the catching power was much greater than the curing strength, so that there was a serious risk of more herrings being landed than could be cured or otherwise disposed of, with the inevitable result that the guarantee would become inoperative, as it would be impossible to secure a price for herrings for which there was no purchaser. In order to provide against this, the Herring Fisheries Executive Committee made arrangements for stopping the fishing when the amount of fish landed became too great to be absorbed, by keeping the boats in until the glut was cleared away. It was able to enforce these provisions by its control of the coal, as it could deprive any offending vessel of coal supplies for such time as it might think fit. As a matter of fact, this power was exercised on very few occasions because, owing to the unfavourable weather, the quantity of herring caught throughout the season was comparatively small.

When working arrangements had once been made, matters went very smoothly, and the guarantee scheme was thoroughly successful, the fishermen getting as a rule more than 45s. for the surplus herring which were not absorbed by the scheme and were sold fresh. The total amount purchased by the Government under the scheme was about 326,000 barrels.

The marketing of the herring purchased by the Government proved to be a very difficult operation. The only market available for large quantities was Germany, and the German Government had taken control of imported herrings and placed them in the hands of the State-created organisation known as the Reichsfischversorgung. No private person was allowed to import herrings. The Reichsfischversorgung purchased a very large proportion of the Scottish catch on terms of two years' credit, and of the English catch about 260,000 barrels on terms of from three to five years' credit. The remainder were sold privately.

Assuming that the German credits are met as they mature there will be a loss of £111,683 9s. 5d. on the English herring: as will be seen from the following account :—

GOVERNMENT GUARANTEE FOR AUTUMN HERRING FISHING, 1919.

TRADING AND PROFIT AND LOSS ACCOUNT TO 31ST OCTOBER, 1921.

	£	s	d.			£	s.	d.
Purchase of 325.901 Barrels of Herrings of English Cure	1.085.065	14	6	Cash Received		172.336	10	1
Cost of Repacking Herrings	3,713	0	0	Bills Accepted by Reichsfischversorgung—				
Cartage Charges and Freights, Harbour Dues, &c. ...	17.425	17	1	1st Contract	£607,649 13 6			
Salesman's Commission	5,387	12	4	2nd Contract	386,625 13 7			
Insurance	1,350	0	0					
Interest on Net Advances to 31/10/21 (a)	121 505	0	0		£994,275 7 1			
Administrative Expenses (b)	2,573	18	3					
				Value of above at 31st October, 1921		948.926	5	4
				Fees for Inspection of Herrings		4,074	17	4
				Balance—Loss on Scheme		111.683	9	5
	£1,237,021	2	2			£1,237,021	2	2

BALANCE SHEET AS AT 31ST OCTOBER, 1921.

	£	s.	d.		£	s.	d.
Net Exchequer Issues to 31/10/21	936,134	14	9	German Bills (value at 31/10/21)	948,926	5	4
Interest Reserve	121,505	0	0	Loss on Scheme	111,683	9	5
Insurance Reserve	1,350	0	0				
Administrative Expenses	1,620	0	0				
	£1,060,609	14	9		£1,060,609	14	9

NOTES.—(a) Interest has been calculated at current Bank rates to end of October, 1921, the date of the final transaction under the 1919 Guarantee.

(b) The expenses of administration on the following payments: Expenses of Gratuities to Scottish Officers, &c., £953 18s. 3d. The balance is made up as follows:—

Salaries (part) and travelling expenses of Chief Inspector £250; Principal Clerk £100; Assistant Fishery Officer £250; Other Headquarters Staff £150; Services of Scottish Officers £620, and other overhead charges £250.

Insurance premiums charged are the estimated premiums to cover loss by fire.

The Trading and Profit-and-Loss Account for the Scottish scheme is printed on page 132 of the volume of Trading Accounts and Balance Sheets, 1920-21.*

The Scottish scheme resulted in a profit of £233,904 8s. 8d.†

THE SEASON OF 1920.

In spite of the distinct intimation which had been given at the time when the guarantee for the Autumn fishery of 1919 was given that the Government would not further subsidise the industry, the herring industry again approached the Government in 1920, and asked not only that the guarantee should be renewed, but that it should be very considerably increased. The application was at first refused, but with characteristic persistence the fishing industry absolutely declined to accept the refusal, and ultimately persuaded the Government to provide a subsidy limited to £3,000,000, of which not more than £1,800,000 was to be expended on the Scottish summer herring fishing and the residue upon the English autumn fishing. For this purpose a scheme was drawn up in all respects similar to that of the previous year, with the additional condition that the Government were entitled to take half the profit accruing from any herrings sold privately outside the guarantee. In effect, this did not amount to much.

The catch during the Scottish fishing did not come up to expectations, and only 449,000 barrels were offered to the Government instead of the estimated quantity of 570,000. The balance of money left for the English fishery enabled a purchase of 535,000 barrels to be made. For the English fishery the same arrangements were made as in the former year. Practically the same Committee was appointed, and with the advantage of the experience of the previous year matters worked very smoothly.

In the middle of the fishing the coal strike took place, with the result that the herring drifters, in common with other fishing vessels, were restricted at first to 50 per cent. of their normal consumption of coal and ultimately to 25 per cent. The rationing of the coal among the various vessels was undertaken by the Herring Fisheries Executive Committee. The shortage of coal had, however, very little effect on the fishery. The shoals of fish were close inshore and fine weather prevailed, so that even with the limited supplies of coal, the fishing fleet was able to catch more fish than could be cured, or dealt with in any other way. As a result, during practically the whole of the last part of October the Herring Fisheries Executive Committee were compelled to restrict the sailings of the vessels in order to prevent both Lowestoft and Yarmouth being hopelessly glutted. Early in November sufficient herring had been cured to exhaust the whole of the guarantee, and when that occurred the fishing was rapidly reduced by the departure of the Scottish vessels for home, but a considerable amount of herring was cured outside the guarantee. The total amount of herring purchased amounted to 532,000 barrels.

The difficulties of disposing of the pickled herrings purchased under the 1920 guarantees were even greater than in the previous year. The financial conditions in Central Europe were worse than before; in addition, the shortage of food was not so acute, and,

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* *House of Commons Paper*, No. 126, 1922, price 6s.

† For explanation of the contrast between English and Scottish trading results, see the Introductory Chapter, p. xxiii.

GOVERNMENT GUARANTEE FOR AUTUMN HERRING FISHING, 1920.

TRADING AND PROFIT AND LOSS ACCOUNT TO 31ST MARCH, 1922 (a).

	£	s.	d.
To Purchase of 531,816 Barrels of Herrings of English Cure	1,678,617	18	0
,, Sundry Expenses, Branding, &c.	28	6	0
,, Freight, Cartage, Harbour Charges, &c.	52,626	5	5
,, Auditing Charges	129	6	1
,, General Average and Legal Expenses	20	6	8
,, Agents' Commission	14,507	7	0
,, Administrative Expenses (d)	3,033	12	8
,, Interest on Net Issues at Current Bank Rates... ...	113,097	0	0
	£1,862,060	1	10

	£	s.	d.	£	s.	d.
By Sale by Ministry of 5,835½ Barrels ...	19,617	15	0			
Add Interest to 31st March, 1922, on a/c of deferred payments	1,014	14	6			
				20,632	9	6
,, Receipts under Clause 22 of Guarantee (b)				121	18	7
,, Inspection Fees				8,864	7	4
,, Sale of 525,980½ Barrels by Disposals Board—						
Cash received	500,174	12	6			
Bills accepted by Russian Government £132,789 1 2						
Add accrued Interest to 31st March, 1922 5,716 4 0						
	138,505	5	2			
				638,679	17	8
,, Profit on Exchange				2	0	10
,, Balance, being Loss transferred to Balance Sheet				1,193,759	7	11
				£1,862,060	1	10

BALANCE SHEET AS AT 31ST MARCH, 1922 (a).

	£	s.	d.	£	s.	d.
To Net Exchequer Issues to 31st March, 1922				1,225,258	19	1
,, Sundry Creditors				11	8	0
,, Interest Reserve				113,097	0	0
,, Administrative Expenses Account ...	3,033	12	8			
Less amount paid from Herring Guarantee Vote and included under Net Exchequer Issues	1,003	10	3			
				2,030	2	5
				£1,340,397	9	6

	£	s.	d.
By Sundry Debtors (c)...	8,132	16	5
,, Russian Bills (Value at 31st March, 1922)	138,505	5	2
,, Balance, being Loss transferred from Profit and Loss Account	1,193,759	7	11
	£1,340,397	9	6

(a) The last payments for sales of herrings were received by Disposals Board in March, 1922, and the account has therefore been brought up to that date.

(b) Curers effecting private sales at a price in excess of £3 3s. per barrel, or £3 8s. per two half barrels agreed under this clause to hand over half such excess to the Ministry.

(c Of this amount £4,132 16s. 5d. has since been received by Ministry and arrangements made, with Treasury sanction, for payment of balance in two quarterly instalments.

(d The expenses of administration have been calculated on the following basis:—

	£	s.	d.
Salaries and Travelling Expenses of Assistant Fishery and Branding Officers	950	8	5
Clerical Assistance, &c., and rent of Office at Yarmouth	439	3	9
Services of Scottish Officers	1,204	0	6
Headquarters Expenses (£290) and Overhead Charges (£150)...	440	0	0

No charge has been included for expenses incurred by the Disposals Board as they are unable to quote a figure for their administrative expenses in connection with this Scheme.

NOTE.—No charge has been made for insurance, as Curers were responsible for safety of Herrings until shipped.

consequently, the demand for herrings decreased considerably. At the end of the year the herring in the hands of the Government amounted to 800,000 barrels, and the Government took the inevitable step of announcing to the industry that in no circumstances whatsoever could a guarantee be given in future years. This announcement was made by the Secretary for Scotland and the Deputy Minister of Fisheries at a meeting of representatives of the whole of the industry at the Scottish Office.

It was thought when guarantees were first instituted that if fishing could be kept going for a season or two affairs in Central Europe and Russia, in particular, would become sufficiently settled to enable the industry to carry on without assistance. At the end of this period, however, the position in Central Europe was no better, and that in Russia—by far the most important market—was much worse. The restoration of stable government and sound economic conditions in Russia seemed as remote as ever, and, so far as could be judged, it would be many years before the purchasing power of that country reached anything like pre-war dimensions. It was feared, therefore, that the guarantees had only had the effect of postponing the evil day for the herring industry, and that operations would inevitably have to be very greatly limited during subsequent years.

The total expenditure on the guarantee for the autumn herring fishing amounted to £1,862,060 1s. 10d., of which it is hoped that £668,300 13s. 11d., will, in course of time, be recovered, as shown by the accounts on pp. 29 and 30.

The Trading and Profit-and-Loss Account for the Scottish scheme is printed on page 148 of the volume of Trading Accounts and Balance Sheets, 1921-22.*

The Scottish scheme resulted in a loss of £641,137 6s. 6d.†

North-Eastern Ports.

As an instance of what was done in those ports where no guarantee existed, the arrangements at the North-Eastern ports in 1920 may be mentioned. As usual, a number of steam drifters left Lowestoft and Yarmouth to prosecute the herring fishery out of North Shields. Landings were at first light, and prices consequently high, ranging up to nearly £10 per cran, but early in July landings became very heavy and prices gradually fell to 10s. per cran. At this figure owners and fishermen had to consider whether it was worth while to continue fishing. At a meeting of owners, fishermen and salesmen it was decided that in order to render a continuance of the fishing practicable it was necessary to control the supply in some way, and a Committee was appointed to draw up regulations with the object of maintaining a minimum price of 45s. a cran by means of a restriction of fishing. The Committee decided to close the port whenever the price of herrings fell below 45s. per cran in order to allow the markets to clear themselves. A conference was arranged with representatives from Hartlepool and Whitby with a view to arranging joint action, but Scarborough was not represented. It was decided that the four ports should work as one, all the fleets remaining in port in the event of the price falling below 45s. at any one port. Scarborough, however, would not accept the decision of the conference and remained outside the scheme, which continued in operation at the other three ports. At first a number of vessels sailed in defiance of the Committee's order to remain in port, and as a consequence were laid up for two nights on their return by order of the Committee. A few days after the scheme was brought into operation a general meeting of skippers was held, at which it was decided that, in order to keep the buyers' staffs engaged, only half the fleet should be detained at one time. This arrangement met with the approval of every section of the industry but in practice it was found that the vessels which were allowed to fish during the first night of a closure had an undue advantage over the others as regards prices. The Committee, therefore, reverted to the original scheme, to which the skippers loyally adhered in spite of an attempt by buyers to induce some of them to go to sea by offering 45s. per cran for the herrings. Any such scheme must of necessity be carried on under very great difficulties and the successful organisation of the fishery at North Shields, Hartlepool and Whitby was very creditable.

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* *House of Commons Paper*, No. 92, 1923, price 6s.

† For a commentary on the difference between the English and Scottish trading results, see the Introductory Chapter, p. xxiii.

THE SEASON OF 1921.

The 1921 Autumn Herring Fishing will go down in the history of our Fisheries as one of the most disastrous ever recorded. The full effects of this failure, which brought the finances of the industry to their lowest ebb, can only be assessed at their true value with difficulty and will be felt for many years to come.

The fishery failed in every sense of the word. Hopes of a Government guarantee scheme faded long before the season commenced. The collapse of the mark; the continued closure of the Russian market; the adverse rates of exchange of the countries bordering the Mediterranean, coupled with the fact that these countries were already flooded with past seasons' goods, sealed the fate of the fishing before it commenced. The failure of both the quality and quantity of the herring was the final blow. From the outset, therefore, it was realised that the fishing would require very careful nursing to prevent its entire collapse, and the trade accordingly formed and put into operation a very successful scheme of control.

Prior to the month of September preparations were well advanced for the coming season. Huge stocks of fishery material were arriving daily. Salt was imported from Spain and Germany. Germany sent 4,129 tons to Yarmouth whilst Spain contributed 21,134 tons. Very little English salt was used. Excellent cargoes of boxwood of Swedish spruce were imported. Fish workers from the North arrived, although the influx was not so marked as in previous seasons, since the uncertain prospects of the fishery discouraged curers from engaging large staffs. Nevertheless, the fishing gave employment in Yarmouth alone to approximately 20,000 persons in work immediately connected with it. In addition it must be borne in mind that large numbers of persons were employed in work indirectly connected with the fishing, such as shipbuilding, food and fuel supplies, loading and discharge of vessels engaged in the carrying trade, &c. The workers engaged had, in the main, poor remuneration owing to the scarcity of the herring. Many of the girls remained without work for weeks; carters were often idle; and, owing to the inactivity of the fleet during the earlier part of the season, smaller supplies of coal were required. It was unfortunately a common sight to see the streets thronged with fishermen awaiting the arrival of the herring, and, for the first time in the history of the fishing, groups of fishermen played bowls, and sports of all kinds were indulged in. At the end of the season the majority of the boats settled in debt and it is estimated that at least 95 per cent. of the vessels fished at a loss to their owners. In practically every case the fishermen, on the completion of the " voyage " were in debt to the owners owing to the fact that the money paid by the latter to the fishermen's dependents during the season exceeded the share due to the men when settlement was made. It is on record that many of the girls engaged by the curers did not earn sufficient money to clear their expenses while some returned to Scotland early in the season owing to their employers having decided to abandon operations.

Owing to the poor quality of the herring and its consequent low value on the English market, a number of vessels made landings at Dutch and Belgian ports, but these markets were also adversely affected by the prevailing conditions, and values soon dropped to a very unremunerative level. The greater part of these landings was made at Ijmuiden, but a few vessels ventured to Ostend and Vlaardingen, where markets, however, were no better. Direct foreign landings by fishing craft ceased after the first week in November when the whole fleet concentrated upon the home markets.

The curers of pickled herrings absorbed about 58 per cent. of the catch, and those engaged in the Mediterranean export trade absorbed about 20 per cent. The remainder was disposed of between the kipperers, freshers and others engaged in the home trade for fresh herrings. The kippering section did not absorb its usual percentage of a season's catch, owing to the bad quality of the fish, which led many firms to resort to the unusual practice of obtaining supplies of trawl-caught herrings from West Country ports. The " freshing (export) trade " was active throughout the season. This branch of the industry, which had only recently been opened at Yarmouth, has made rapid advances since the conclusion of the war. It is one that has come to stay at this port and in a few years will no doubt rival the " Klondyking "* industry at Lowestoft. Owing to the depreciation of the market for canned herrings, very few were put into tins this season. This section of the industry depends mainly upon Australasia and South Africa for its markets, but has also begun to send small quantities to China. There was practically no demand for canned herrings in the United Kingdom. The Mediterranean export trade continued to suffer from the stagnation of the Italian,

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* The export of fresh herrings.

Greek and Egyptian markets, and deliveries to these countries were slow throughout the season. The railway companies gave every facility for the carriage of fish and no complaints were made of delays in despatch or transit.

Coal supplies were maintained satisfactorily and vessels were coaled without delay. The quality of the coal was not up to the highest standard, but there was an appreciable fall in prices as compared with the previous year. Ice supplies adequate to meet all demands were maintained during the season. The loss of gear was small when compared with that of other seasons. In many cases gear was scarce at the commencement of the fishing, especially among the Scottish vessels, and skippers appear in consequence to have exercised greater care when fishing.

A word must be said about the work of the Welfare Centres, which is commonly ignored both by those engaged in the industry and by the Press. Welfare work among fish workers has always been carried out by bands of voluntary workers, and although a Home Office Welfare Order makes the employer responsible for the care of the worker, it is safe to assume that the volunteer welfare worker will remain. The Home Office Order had a limited effect during the 1921 season. Many curers fulfilled the conditions laid down and carried out the work very thoroughly. The Yarmouth Corporation succeeded in opening one centre, completely equipped, to meet the varied needs of the fisher girls. First aid, meals and light refreshments were available; whilst drying and dining rooms afforded comfort upon wet days and at meal times. But voluntary centres maintained their services upon the same scale and did excellent work throughout the season. These societies superintended the girls while travelling, found lodgings for them upon arrival, and saw to their comfort upon the pickling plots by providing them with rest rooms, food and hot drinks, and rendered first aid to the many who required it. It is not possible to give details of the activities of the many societies but the following figures relating to only one centre illustrate the excellent and important work carried out. This particular centre rendered first aid to 1,215 patients. It supplied 7,417 hot drinks and light refreshments, whilst the total number of attendances reached 15,717.

THE SEASON OF 1922.

Probably no East Anglian Herring Fishery within memory has been faced with a more gloomy outlook than was that of the autumn of 1922. All those factors upon which preparations are normally based were either so unpromising or so undetermined that every section of the herring trade was marking time until the very opening of the fishing. The whole industry had suffered from the disastrous season of 1921 to a crippling extent; the earlier fishing off Scotland and the North-East Coast had proved far from satisfactory, though there was an indication of improved quality. Conditions in Russia were no better, and the German mark was going from bad to worse.

Nevertheless hope was derived from two facts. The Shetland fishing had proved unexpectedly successful, and a ready sale had been effected of the catch, principally to German buyers, while the whole of the previous autumn season's catch had been disposed of by June. In considering this factor, however, it must be remembered that the mark had not then collapsed to the level reached late in the year. Again, there were indications that an avenue into Russia had been found by way of Border States. As the Autumn season progressed, direct shipments were made to Petrograd.

The position at Yarmouth and Lowestoft in the middle of September was such then, that, while one owner who laid up his drifters for the fishing of 1921 was sufficiently optimistic to fit them out, another laid up the whole of his fleet. No steamers containing fishing stock (barrels and curers' working materials) had arrived, as compared with a considerable number the previous year, and there were no indications as to the extent of the curing which would be undertaken.

This hesitancy continued throughout September, and it was generally conceded that never since the days of sailing drifters had preparations been on so small a scale. At the end of the month the Yarmouth Corporation offered to reduce the rents of open plots by 50 per cent., but no curers gave notice of acceptance. Only among "Klondykers," or exporters of fresh herrings, was there any marked activity, and in view of the rapidly fluctuating exchange rates, their prospects of successful trading appeared to be small. In the early days of October, however, the reduced fleets working made good catches. The fish were of good quality, but small. Prices were low, and at Yarmouth fresh fish fell to 6s. per cran, and "overdays" herrings were carted away for manure. Curing began on a much smaller scale than in the previous year; 141 curers employing 3,225 women were engaged as compared with 182 curers employing 4,596 women in 1921. On several shipments made to Germany by "Klondykers" expenses were not cleared, herrings fetching only 13,000 marks per cran, or about the cost of the fish at this side. The class of herring landed was not entirely suitable for the kippering or "red" trade, and large quantities of trawled herrings from the West of England were consigned to Yarmouth and Lowestoft for these sections of the industry.

Towards the end of October, prices improved and the difficulties associated with the beginning of the month as regards disposal of catches were never again threatened. The last few days of the month ushered in a series of gales, which continued intermittently for a fortnight, and seriously interfered with fishing. The shorter supply, together with an improved demand, resulted in a general stiffening in prices. By the end of the first week in November a considerable proportion of the cure was reported as sold, certain purchasers being reputed to be acting on behalf of Russia. Exporters continued to buy heavily, a steady demand from Germany being met both at Yarmouth and Lowestoft.

Further spells of heavy weather resulted in the drifters losing touch with the herring shoals. Towards the end of November many Scotch drifters returned home, and curing operations were brought to an end. But now a dramatic change came over the situation. The depleted Scottish fleet was to some extent replaced by some local drifters, which up to now had continued seine fishing and had thus avoided the period when herrings were cheap. Just when the season appeared to be at an end, owing to the failure to locate the shoals, the unceasing efforts of the local fleet, which had searched from Cromer Knoll to Sandettie, were rewarded. The herrings were located in the neighbourhood of the Galloper and Hinder Lights, and very heavy catches were made, one vessel discharging 220 crans on the 24th November. Owing to the position of the shoals many drifters made a practice of running almost daily with their catches to Ostend, where more herrings were handled than had been the case for many years. Fishing was carried on into the Channel as far as Dungeness. Demand for both the home and German markets was extraordinarily keen.

In an endeavour to make up some of the leeway arising from the partial failure of the Dutch fishery, catches of herrings were bought at East Anglian ports and cured aboard Dutch drifters. It now became fully evident that there was a shortage of supplies in the cured market, and, but for inability to finance the operation, there seems little doubt that the whole cure would have by this time passed into German hands. The Germans were, however, able to purchase small parcels only, on account of increasing exchange difficulties.

Large catches of herrings of an improved quality continued to be made, and prices reached remarkable levels, which were well maintained. A diminished fleet at Lowestoft brought in more herrings during the last week in November and the first week in December than had been taken by the full fleet during the previous fortnight. At Yarmouth quantities were not maintained, but the average catch per landing showed a marked increase, as also did the prices obtained. It must be remembered that at this port the Scottish drifter plays a relatively more important part than is the case at Lowestoft, which is more self-contained.

The last three weeks of the season may be said to have turned defeat into victory for those who stayed out the fight. Many of the smaller owners were just saved from bankruptcy; no fortunes were made, but on the other hand, no great losses were incurred.

As regards local drifter owners the season may be looked upon as successful rather from the point of view of morale than from that of large profits. While the majority of Scottish vessels grossed between £400 and £1,200, a few local boats reached the £2,000 limit, and very few failed to gross £1,000. Thus encouraged, owners fitted out for seining and mackerel voyages, and a larger number of drifters than had ever previously made the voyage proceeded to fish for herrings from Plymouth.

A noteworthy feature was the ability of fresh herring exporters to compete with the home demand. So great was the demand from Germany that at the close of the East Anglian fishery, German carrying trawlers proceeded to Plymouth to load. The steady buying of Dutch merchants, too, occasioned much surprise locally; as already mentioned, they bought at the markets and cured aboard their drifters lying in the two harbours.

The end of the curing season found Scottish curers, Mediterranean exporters and the new Dutch curers short of supplies. The cautious policy adopted in view of disordered foreign markets, was, however, justified, for the curing section of the industry stood firm on its own feet for the first time since the war.

The estimated total quantities of gutted herrings cured for export as compared with the previous year were as follows :—

	1922. *Barrels.*	1921. *Barrels.*
Yarmouth	252,474	267,635
Lowestoft	86,375	104,647
	338,849	372,282

The whole of the 1922 cure was exported by about the end of April in the following year. A note as to the number of barrels branded with the " Crown " brand will be found in Chapter VIII.

The measure of success of the fresh herring exporters may be gathered from the fact that the Great Yarmouth Port and Haven Commissioners decided to construct an export quay at the extreme end of the loading wharves, thus enabling Great Yarmouth to offer facilities in this respect far in excess of those at Lowestoft.

There was little indication of improvement in the " red " herring trade. The sudden slump in this trade which took place in November, 1919, has been followed by a continuous series of disasters, culminating in the general failure of the autumn fishing in 1921. The quality of the fish during the season under review, although decidedly better than in 1921, was not up to standard for the curers of " reds," and the instability of the markets of the Mediterranean countries was against export on a large scale. Indeed, the exchange rate of the lira, the instability of the Greek Government, and the unsettled condition of the Levant, allied to the difficulties usually associated with trade with the peoples of these regions, rendered the export of red herring so profitless that some local merchants who specialise in this cure cut down their staffs and turned their attention to other sides of the fishing industry.

During the greater part of the season the entrance to Lowestoft Harbour was extremely difficult to negotiate owing to silting up on the northern side. Much time was lost, and to add to the difficulties, a drifter ran ashore on the sand bank which had formed, and was not got off for several days. Many drifters took their catches to Yarmouth, others lined up in the Roads and waited for the tide. As a result, on many occasions, jams occurred at the harbour mouth and considerable damage was done. Great Eastern Railway dredgers worked incessantly at the bank, and by the time a large Dutch dredger (of the type used in the Maas) arrived, the entrance was sufficiently clear to offer no difficulty to the reduced fleet.

THE SEASON OF 1923.

The results of the herring fishery off the Shetland Islands in the summer months were held to be the key to the East Anglian fishery in the autumn. It may be said that the fullest resources of the industry were put into the Shetland Fishery, and its outcome was watched with the keenest anxiety by all sections of the trade. But bad weather, patchy distribution of the shoals, and Continental unrest combined to make the immediate results of this fishery little short of disastrous. The total catch was greater than that of the previous year, but it was unevenly shared amongst the drifter fleet. Owing to a trawler strike in Germany, exporters of fresh herring were seriously limited in their activities. Thus the bulk of the catch was taken by the curers at a cheap rate, in the hope that the insistent demand for herrings which was known to exist in Germany and the Baltic States would prevail over difficulties of exchange and irresponsibility of government. The average price paid to the catcher seldom rose above 10s. per cran.

In spite of the headlong fall of the mark, and increasing trouble in the Ruhr, there was a persistent rumour in well-informed quarters at the beginning of August that the whole of the Shetland cure had been disposed of. Nevertheless, a spirit of the deepest pessimism had taken hold of the greater part of the industry. A threatened rupture in the Entente increased this depression almost into panic, and meetings were held in Lowestoft and Yarmouth which led to the Ministry of Agriculture and Fisheries being approached as to the prospects of a further guarantee.

The blackest clouds on the political horizon passed over, and a more optimistic tone crept into herring circles. Boat owners realised that their only hope was to keep on, and to attempt to reduce their losses by cheapening the cost of catching to the utmost extent. Everyone felt that the German demand for cheap herrings would lead to a repetition of the experience gained in the Shetland voyage, and that the autumn voyage of 1923 would be chiefly notable for herrings sold at a minimum price. In spite of the limitation of the purchase of sterling in Germany, it yet seemed that the possibility of trading with that country was by no means unlikely; that trade could be carried on at normal prices, however, was thought to be out of the question.

During August news of the settlement of the German trawler strike and ratification of the rumour that the whole of the Shetland cure had been sold, changed dismay into hope. The whole herring trade suddenly became convalescent. The report that many blank sales had been made acted as a tonic to boat owners, curers and freshers alike. Towards the end of the month several cargoes of salt from Spain were discharged. Satisfactory assurances from their agents in Germany were received by fresh herring exporters, and prospects for this section of the trade became decidedly brighter. Mediterranean exporters, too, made extensive preparations, all the indications pointing to the class of fish being more suitable for their trade than had been the case for some years.

An early shoal of herrings of excellent quality was met with in the vicinity of the Dowsing, but the general situation early in September was somewhat obscure. Fishing stock came through but very slowly, and it was not until 22nd September that the first Scotch drifters made their appearance at Yarmouth. From this date, however, the most active preparations were made by all sections of the trade, with the sole exception of fresh herring exporters, who were still uncertain as to their requirements, owing to the fact that Germans were purchasing herrings trawled by their own vessels, and sold at a rate prohibitive to British competition. The new quay at Great Yarmouth specially prepared for this branch of the industry was ready for service.

By the beginning of October the fleet operating at Yarmouth had increased to 600 and a little more than half that number were working from Lowestoft. The early promise of abundant herrings was not fulfilled, but the quality remained fair, and prices far above all expectations were paid for the fish. A larger number of curers were operating at the two ports than was the case in the previous year, and at Yarmouth an Irish firm, with a crew of Irish girls, for the first time visited the port. Their requirements were not met, however, by the small landings of fish, and it was feared that the leeway arising from oversales, estimated at 47,000 barrels, could not be made up unless at a loss. The curers' price per barrel had by this time risen to 30s. for matties, and 32s. for matfulls, whereas a large part of the blank sales had been effected at a figure in the neighbourhood of 23s. per barrel. Mediterranean exporters, on the other hand, bought freely, the quality of the fish turning out even better than they had anticipated.

The period of maximum production fell, as is customary, towards the end of October, although an unfortunate succession of gales seriously impeded fishing operations. The fish off East Anglia are then in the best condition for hard curing of any herrings around the British Isles. With the waning of the October moon passed away all hope of cheap herrings. Big hauls were made for which astonishingly high prices were paid, amounting to sums between 6s. 7d. and 15s. 3d. per cran more than were obtained in 1922. The earnings of some boats had by the end of October exceeded those of the whole of the previous year. A disquieting feature, however, was the serious loss of nets incurred through bad weather and weight of fish. Very heavy losses of this nature had already been sustained in the Shetland voyage, and in the rush which now took place to fit out every available boat for herring fishing, this factor became of increasing importance. The lean post-war fishings had discouraged the renewal of nets and wherever possible old and worn gear of a nature unsuited to the strain of heavy hauls of fish and bad weather, had been pressed into service. Although the earnings of seine drifters were still quite satisfactory, many of these vessels were refitted for drifting, and some vessels which had not been at sea for three years were fitted out.

"Klondyking" made a tardy commencement on the 18th October, and continued fairly steadily in spite of industrial and political troubles in Germany. The various tinning factories were busier than had been the case for many seasons. Shipments of smoked herrings to Mediterranean ports were made on an extensive scale, and the relaxation of Italian import duties removing one of the obstacles to trade in this region, the curers interested in this trade laid in large stocks. A remarkable demand from home centres for herrings of a lighter but similar cure was one of the features of the season.

The early days of November were notable for a distinct decline in the average catch. Many large shots were made by individual boats, most of which were discharged at Ijmuiden, but throughout the fleets there was an indication that the shoals had dispersed. At an unusually early date spent herrings made their appearance in large quantities. The search for herrings which normally takes place considerably later began from both Yarmouth and Lowestoft.

A fortunate conversation between the Captain of a French fishery cruiser lying in Lowestoft and the Commander of H.M.S. " Truro," which was reported to the District Inspector, Eastern Area, and communicated to drifter owners at Yarmouth and Lowestoft, led to several successful voyages to the Sandettie ground. It appears that the news of good hauls having been made on that ground by French drifters was originally communicated by wireless. Considerable doubt was expressed as to the advisability of trying this ground so early in the season, but after one successful trip many others followed.

The weather during the greater part of November was adverse to successful drifting operations, but, although the fleet were unsuccessful in locating large shoals of herrings, fair hauls were made from the Cromer Knoll, Smith's Knoll, and Sandettie grounds. Prices, moreover, maintained a steady high level, the demand proving keener than ever. Some exceptionally remunerative shots, occasionally approaching £400, were landed at Ijmuiden. Towards the end of the month, Scotch drifters, whose supply of nets in many cases was exhausted, left Lowestoft and Yarmouth in gradually increasing numbers for their home ports, so that by the last days fishing was almost entirely prosecuted by local boats.

The demand for herrings of almost any quality was now so great that " Klondykers " made preparations for operations from Plymouth, and some Scottish curers announced their intention of curing at St. Ives. The cured market gave evidence of increasing firmness, but the majority of the curers were not prepared to gamble on the uncertainty of a December fishing at Yarmouth and Lowestoft and left the field clear for the freshers and exporters. Their cure was considerably in excess of that of the previous year, and by the beginning of December nearly one-half had been shipped to Germany, Poland and the Baltic States.

The successful secondary fishing which alone saved the autumn season of 1922 from complete failure was not repeated to the same extent in the season under review. Early in December light catches were the general rule, with occasional good shots. The usual grounds off Smith's Knoll were worked, but the best hauls were made off the Sandettie Light Vessel and Eastbourne, and many catches from these grounds were taken direct to Ijmuiden and Ostend. Quality was on the whole well maintained, and prices continued to reach high levels. Although " Klondykers " were the largest buyers, the home demand remained consistently firm.

The season dragged on until the third week in December, but the majority of the local fleet had " made up " by the end of the second week. Those with the courage and patience to keep on till the last moment were handsomely rewarded by some exceptional catches, obtained in the final trials of the grounds off Sandettie and the Goodwins. Landings were made direct at Ijmuiden at a time when there was a very strong demand from Germany, with the result that some notable " grossings " were recorded, one shot of 220 crans realising £957. It is not often that a period of abundant catches corresponds with a ruling price of from £3 to £4 per cran.

Contrary to all anticipations, the Autumn fishery of 1923 will be recalled as a fishermen's season. But while owners and crews in many cases reaped a harvest beyond their most sanguine expectations, it cannot be said that any branch of the industry was unsuccessful. Probably the smallest margin of profit fell to owners, who in addition to heavy losses in gear were faced with big deficits from previous fishings. Scots fishermen, as in the previous year, did not fare so well as the local men : they were of necessity more careful of their gear, their week-ends in port on several occasions robbed them of profitable hauls, and they returned home just before the period of keenest demand, when exorbitant prices were ruling. Curers and " Klondykers " were more than satisfied with their transactions, not perhaps so much on the score of immediate results, as of the possibilities of future trade with Germany and Russia which were revealed, in spite of apparently hopeless restrictions. Reference has already been made to the keen home demand, which was one of the greatest surprises of the season; in some cases merchants who had hitherto chiefly specialised in the Mediterranean trade, found it more profitable to explore more fully the safer channels of the home market. But the Mediterranean traders, particularly at Yarmouth, who had been working up new connections during the past year in the Levant and Eastern Mediterranean generally, had, for the first time since 1919, satisfactory material to work on, and the fact that after the season they found it necessary to supplement their supplies with Norwegian herrings, would suggest that this branch of the industry has very considerably revived.

Buying by Dutch merchants at Lowestoft and Yarmouth was on a smaller scale than during the previous year, but curing was carried on to a certain extent aboard their drifters lying in harbour. It had been stated that these merchants were contemplating the hire of curing premises, but this was not done.

Very few boats settled in debt. While the best results at Yarmouth and Lowestoft respectively were £3,600 and £2,900 (gross), the average " grossings " were in the neighbourhood of £1,200 to £1,500, with a few below £1,000. Some of the most successful vessels, as in the previous year, were those which had been engaged in seining until bad weather and long nights rendered this form of fishing unremunerative. One seiner, after fitting out for drifting, " grossed " no less than £2,700. Thus, for the first time for two or three years the majority of the fishermen had money to take at the conclusion of the voyage. Increased employment of shore workers of every description in curing yards, net stores, tinning factories, &c., was another noteworthy feature, and it may be said that during the season under review unemployment was at its lowest ebb since the war in Yarmouth and Lowestoft.

In addition to the serious losses of gear already referred to, the factor of high-priced coal has always to be set off against increased earnings. During the season, with the maximum effort made to obtain herrings, this factor became insistently important. Although spells of bad weather forced the majority of the fleet to remain in harbour at times, this saving of coal was more than counterbalanced by the consumption on bad weather trips and long-distance steaming to Sandettie and Eastbourne, with frequent calls at Ijmuiden and Ostend. Fortunately no difficulty was experienced in keeping up ample supplies of coal and oil.

The work of the Fishery Protection Cruisers was carried out in so thorough and efficient a manner that complaints of damage by foreign vessels were reduced to a minimum. In addition, the Fishery Protection vessels were able on occasion to contribute very materially to the saving of valuable gear, by making known warnings, which they had received by wireless, of approaching gales. A daily weather report was supplied by the Local Fisheries Naval Officer and posted up in the Trawl Market Office at Lowestoft.

Arrangements which, on the suggestion of the District Inspector of Fisheries, Eastern Area, were concluded between a prominent Yarmouth firm of fish salesmen and the Meteorological Office for the supply of daily weather forecasts, proved of great value.

STATISTICAL SUMMARY: 1919 TO 1923.

The following tables sum up the statistical position of the herring fishery at the two ports during the five years 1919 to 1923, as compared with the latest pre-war year, 1913. It must be remembered, however, that the Autumn herring fishery in 1913 constituted a record.

The East Anglian Autumn herring season extends over the four months, September to December, although the great bulk of the herrings are caught in October and November. The total quantities landed at Yarmouth and Lowestoft in each of the four months in each of the years under review as compared with 1913 were as follows :—

	1913.	1919.	1920.	1921.	1922.	1923.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
September ..	106,266	171.681	278,320	81,875	60.315	105,456
October ...	3,249,919	1,410,481	2.285,406	966,089	1,153,582	1,486,597
November ..	1,762,652	1,063,582	1,191,076	1,004,813	690,834	597,196
December ..	134,175	83,293	56,746	110,381	107,494	29,628
Total—Sept.-Dec. ...	5,253,012	2,729,037	3,811,548	2,163,158	2,012,225	2,218,877

The quantity and value of the landings at the two ports taken separately during each season were :—

	1913.	1919.	1920.	1921.	1922.	1923.
Quantity.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Yarmouth ...	3.109,423	1,726.513	2.339.265	1,367.973	1.291,020	1,448.910
Lowestoft ...	2,143,589	1,002,524	1,472.283	795.185	721,205	769,967
Total ...	5,253,012	2,729.037	3,811,548	2.163.158	2,012,225	2,218,877
Value.	£	£	£	£	£	£
Yarmouth ...	867,949	1,168,060	1,237,679	351,106	322,481	515,383
Lowestoft ..	606,379	685,471	896,663	224,208	212,667	286,798
Total ...	1,474,328	1,853,531	2,134,342	575.314	535,148	802,181

The number of landings and the quantities secured by the various classes of boats (distinguishing steam, sailing and motor) at the two ports taken together are given below. Practically the whole was drift-caught, the only other method, trawling, being at its maximum in 1922 with three landings totalling 26 cwts.

	1913.	1919.	1920.	1921.	1922.	1923.
Number of Landings:—	No.	No.	No.	No.	No.	No.
Steam—1st Class ...	30,722	19,917	23,437	19,874	17,241	15,795
Motor—1st Class ...	1,140	4,235	2,183	1,411	1,718	1,027
2nd Class ...	—	47	89	108	533	154
Sailing—1st Class ...	1,162	1	—	—	—	—
2nd Class ...	—	53	81	108	362	351
3rd Class ...	11	53	110	44	706	149
Total	33 035	24,306	25,900	21,545	20,560	17,476
Quantities Landed:—	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Steam—1st Class ...	4,991 413	2,347,350	3,558.739	2,026,559	1,857,135	2,107,991
Motor—1st Class ...	135,208	380,617	251,659	135,577	145,253	107.588
2nd Class ...	—	350	561	497	4,259	1,175
Sailing—1st Class ...	126,350	37	—	—	—	—
2nd Class ...	—	348	248	417	2,096	1,627
3rd Class ...	41	335	341	108	3,482	496
Total	5,253,012	2,729,037	3,811,548	2,163,158	2,012.225	2,218,877

CHAPTER IV.—THE INSTALLATION OF MOTOR ENGINES IN FISHING VESSELS.

The Work of the Motor Loan Committee during 1919 and 1920.

In the last Report on Sea Fisheries* it was stated that nearly the whole work of the Motor Loan Committee had been concerned with the installation of engines in boats primarily built for sailing. It was also explained that funds had been placed at the disposal of the Committee for the experimental construction of fishing boats built primarily for motor power, and that designs of boats in which sails were only to be auxiliary had already been prepared. In designing the various types of standard motor vessels the Committee endeavoured to limit so far as possible the number of types. It was, of course, realised that more than one type would be necessary owing to the varying conditions at the ports from which these vessels would fish, but reasons of economy dictated that the types should be as few as possible, the intention being to produce a standard design in each case which would be equally suitable for a large number of ports.

By the end of 1919 three trawlers had been laid down, while the designs for drifters were sufficiently far advanced for the Committee to get into touch with suitable firms with the object of placing contracts for the construction of four vessels of this class.

The cost of the first trawler was met from the fund of £6,000 for experimental work, which was granted in 1919 by H.M. Treasury. It was intended that certain innovations which appeared to be of practical utility to the fishermen should be given a trial in this vessel, and one of these innovations, viz., a capstan driven by compressed air instead of steam, was actually fitted before the vessel was employed at sea.

The dimensions of the vessels which were constructed are given below :—

	Trawlers.	*Drifters.*
Length O.A. ...	46 ft. 0 in.	42 ft. 0 in.
Length B.P. ...	40 ft. 0 in.	36 ft. 9 in.
Beam extreme ...	13 ft. 0 in.	12 ft. 0 in.
Depth moulded ...	6 ft. 0 in.	6 ft. 0 in.

The design of these standard vessels was influenced not only by the local conditions at various ports but also by the kind of fishing which it was proposed to carry on. If these two factors had been the only ones which the Motor Loan Committee had to consider, the vessels might with advantage have been of larger size, but the Committee had also to take into consideration the fact that one of the principal objects of the scheme was to maintain a class of fishermen spread all round the coast and carrying on their industry in a way that gives scope for initiative and develops the ability for independent command.

It was evident that a larger hull would necessitate higher engine power, and as, at the time when these vessels were being designed, running costs were rising rapidly while the price of fish was declining, the Committee considered that it was unwise to build vessels of the maximum size. As a result of experience, however, it appears that, had the size of the trawlers been increased slightly, they would have cost little more to run whilst their catching power would have been materially greater owing to their ability to keep the sea in heavy weather. The drifters, on the other hand, appear to suffer from lack of engine power rather than from lack of size.

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* *Fisheries in the Great War*, being the Report on Sea Fisheries for the years 1915 to 1918. For particulars see cover.

The quotations given by the various firms who were asked to submit tenders for the construction of motor boats differed considerably. This was attributed to the fact that many of these firms were accustomed to the carrying out of highly finished work for the Admiralty while other firms had been more or less confined to the construction and repair of fishing and trading vessels.

The progress of the constructional work was not so rapid as could have been desired, and the delivery of all the boats which were constructed was delayed. In some instances the firms entrusted with the work did not understand completely the requirements of a fishing boat; the moulders' strike retarded the delivery of the engines; owing to pressure of work the glass industry was unable for some time to supply the coloured lenses required for navigating lamps; the stock of standard fittings was limited and work had sometimes to be replanned to permit of the only available fittings being utilised.

These delays were unfortunate as they resulted in the scheme being launched at a time when the fishing industry was experiencing one of the worst slumps ever remembered.

The first three of the four trawlers built were fitted with electric light, the current being supplied by a dynamo driven off the engine. The decks can be well lighted when the trawl is hauled, and there are no naked lights in the engine room, thus reducing considerably the risk of fire. Unfortunately the human element comes in here, and experience has shown that the Committee went too far when they provided for electric light on these vessels. There is no doubt that eventually electric light will be used on fishing vessels of this class, but apparently the fishermen are not ready for this development at present. The average fisherman cannot or will not be bothered to give that little extra amount of attention necessary to ensure the complete success of the electric light plant. So long as it works in a satisfactory manner he welcomes the innovation, but when it goes wrong or gives trouble, usually through lack of attention on his part, he clamours for a return to the oil or acetylene lamp.

The Committee, as stated above, also used some portion of the £6,000 given for experimental work in an endeavour to design a capstan driven by compressed air. There are many objections to the installation of a steam capstan on a motor vessel. A steam capstan necessitates the provision of a boiler and furnace, both of which take up space which can ill be spared, and result not only in the generation of heat but also in the dissemination of dust and dirt. There is also a grave risk of fire owing to the possible scattering of hot cinders when the boat is rolling. The compressed air capstan was not installed until the spring of 1920, and the result of the initial experiments was satisfactory. The Motor Loan Committee was able to enlist the interest and help of manufacturers, whose sympathy is gratefully acknowledged. No special machinery was designed owing to the lack of available data, and it was therefore decided to use a capstan similar in type to the ordinary steam capstan, but to change the driving power from steam to compressed air. In the interests of economy both of money and space, it was decided not to make any provision for the storage of compressed air but to supply the power direct from a standard compressor driven off the main engine. Many improvements in detail have yet to be made, but the Committee is satisfied that the capstan has worked as well with air as it did with steam. If only the air-driven capstan can be made at a cost no greater than the steam driven one the motor boat of the future should be rid of the necessity of installing a boiler and furnace. Unfortunately the innate conservatism of the fisherman is an even greater obstacle to an innovation of this kind than any difficulties of design.

The work of installing motors in sailing fishing boats proceeded on the lines hitherto followed. In August, 1920, the terms upon which loans were granted were modified, the interest being raised to 5 per cent., an administration charge of 5 per cent. being made, and loans being confined to ex-Service men. On 31st March, 1921, the number of installations had reached 400.

Installation of Engines in Cobles.

A new development of the Committee's work was the installation of engines in the Flamborough cobles. The cobles, owing to lack of anchorage, have to be brought high upon the beach for safety, and the main problem which confronted the Committee, apart from the consideration of weight, was how to dispose of the propeller so that it should not be injured in the hauling of the boat up the steep slope. In order to reduce the diameter of the propeller it was made with four blades and, to protect it against damage, was housed in a kind of tunnel. This tunnel had two additional advantages. It kept the propeller clear of lines and nets and did not affect the reserve of buoyancy of the vessels as is the case when a deepened keel is added.

The Committee was fortunately able to purchase the last of a batch of engines built by a firm which was closing down and, after careful experiment, modified these engines in such a way that they were capable of running at slow speeds. Three of these engines were installed in cobles and the results have been in every way satisfactory.

The Brixham Armed Guards.

The last Report* made mention of certain vessels that were engined by the Committee and armed by the Admiralty for the protection of the fishing fleets. It had been agreed with the owners of these vessels that when their charters expired the engines should be removed and the vessels reconditioned free of charge, unless the owners liked to take the engines over at a valuation either by immediate purchase or under the loan system. Accordingly, in the spring it became necessary for this arrangement to be carried out.

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* See footnote on p. 44.

Of the eight vessels two had been lost, one by fire, and one is believed—for no trace of her was ever found—to have gone down in a severe gale in the Bristol Channel. The owners of five out of the remaining six chose to take over the engines. The other vessel was reconditioned by the Committee's shipwrights, and the engine sold by the Committee. The total cost of the undertaking was £5,180; not a great expense when it is considered that, by means of it, about 150 vessels were enabled to go to sea regularly over a period of eighteen months.

Experience with the Armed Guards suggests that there is a limit of size beyond which conversion to motor power cannot at present successfully go. There is no insuperable obstacle, but when engine parts reach a certain size they are beyond the capacity of the lathes and other machine tools that the local shops usually employ. A repair, therefore, that is done locally for the smaller engine involves for the larger the delays of consigning the part to the manufacturer or to some nearer machine shop that can deal with it. The larger the engine the more extensive is the damage done by any neglect of lubrication. Further, the engines that are most efficient for the larger boats are of a type that few local repairers have yet learnt to understand, nor does a fisherman care to undertake the charge of them. Consequently, in addition to the fisherman crew it is necessary to import a skilled engineer, thus increasing working costs and diminishing the earnings of the vessel. One advantage of the motor thus disappears. Up to a certain size it fits in admirably with local conditions everywhere; beyond a certain size it begins to demand marine engine room hands and large machine shops. It is doubtful, as far as concerns the working owner of a single vessel at one of the smaller ports, if an engine above 40 h.p. will be a success.

At the time when these larger vessels were engined the choice of engines was limited and quick delivery was of first rate importance. Moreover, there was little experience to guide choice. It is possible that when the present period of depression is over it may be feasible again to try the installation of larger engines. The owners might surmount much of the difficulty of upkeep by combining for such a scheme as was promoted by the Committee for the small fleet of Armed Guards working out of one of the western ports. There the Committee arranged with the owners for the provision of a mechanic and a small workshop. He was to have a fixed salary for looking after these engines, and a percentage on the charges made for any work he did for owners outside the agreement. These charges went towards paying him, and the balance was made up by the associated owners in proportion to the attention their engines had required. The Committee kept the accounts and collected the payments.

Financial Difficulties.

It was not only on the mechanical side that difficulties were encountered and this Report would not be complete if no mention were made of the difficulties of administration.

Owing to the drop in fish prices the closing months of 1919 brought an increase in arrears of repayments of loans and this increase continued through 1920. The problem was then how to reduce the arrears or, better still, to assist borrowers to keep their repayments up to date.

Few fishermen have banking accounts and most save their money in a cash box kept under the bed or in a cupboard. The engine's share is set aside against the repayment due every six months; but with all the will in the world there come times when the cash box is empty; the family must be fed or a payment for gear has to be met, and the only ready means is a part of the engine's share. The end of the six months finds the engine money insufficient to make up the full payment. It was to obviate this that the new system of repayment was started.

Each man had issued to him a Post Office Savings Bank Book made out in the name of the Minister of Agriculture and Fisheries. Into this he could pay money as he earned it but once paid in the money could not be withdrawn.

The arrangement is greatly to the advantage of all; the borrower saves interest, for money so paid is treated as though it had been paid direct and interest is only charged on what is outstanding. The country gains in that money which would otherwise be lying idle goes at once into the Exchequer.

The scheme was tried at first in a few ports but so great has been its success that applications for Post Office Books came from nearly all the ports at which there were loans and the men were unanimous in their praises of the scheme. The scheme has now been extended to all holders of loans.

THE WORK OF THE MOTOR LOAN COMMITTEE FROM 1921 TO 1923.

The subsequent history of the scheme may be outlined very briefly. In view of the financial stringency which became apparent in 1921, it was decided to withdraw the facilities for granting further loans on the 31st December, 1921. It was apparent that the majority of fishermen had by that time had ample opportunities of obtaining loans if they desired to avail themselves of them. At the same time, the Ministry was anxious to retain at least a discretionary power to grant further loans in special cases, *e.g.*, to replace worn out engines, but financial pressure was too strong for it. The course adopted has probably saved the Government some money, but there is no doubt that help was withdrawn from the Inshore Fishing Industry when it was more needed than at any time in its history since 1914. The curve of trade depression is reflected in the decrease in the repayments made annually on the existing loans, and the following Table may be interesting in this connection :—

Date.	Loans Issued to date.		Principal repaid.	Loans in Arrears.	
	No.	Amount.		No.	Amount.
		£	£		£
31/3/19	171	33,566	11,731	8	179
31/3/20	297	63,298	24,340	32	1,443
31/3/21	400	91,744	34,932	124	6,907
31/3/22	430	97,268	43,584	170	13,839
31/3/23	435	101,072*	47,173	214	21,897
31/3/24	435	101,037	59,097	199	21,223

An examination of the figures given above shows that arrears were insignificant up to the financial year ending 31st March, 1920, but that during the remaining months of 1920 and the first three months of the following year, the increase was considerable. The worst period of all was during the year ending 31st March, 1923, when only about £3,600 was received in respect of all the loans outstanding, and the arrears had risen to not far short of 25 per cent. of the total amount of the loans issued.

It will be observed that the total amount of principal repaid now exceeds 50 per cent. of the total of the loans granted, and that the amount repaid in 1923-24 exceeded the 1922-23 repayments by nearly £350. The increase is not in itself a great matter, but it is certainly satisfactory that the downward tendency has at last been checked. Moreover, up to 31st March, 1924, the number of loans repaid in full was 171, representing about £29,463.

Owing to the decline in the profits from the fishing industry cases have occurred in which fishermen were unable even to meet the interest due on their loans. Their liability to the Ministry was therefore increasing instead of decreasing, and steps have been taken in such cases to realise the assets and terminate the loans. This course naturally involves a loss and is only taken where the chances of ultimate recovery from the fishermen are negligible. The security for the loan normally depreciates in value and this natural process has been accelerated to an alarming degree by the decline in boat and engine values which has been so marked a feature of the years under review. Any delay would therefore merely increase the ultimate and inevitable loss.

It is not possible at present to give any indication of the results which may be anticipated when the scheme has been finally disposed of, but signs are not wanting that the ultimate benefit to the Inshore Fisheries will more than counterbalance the cost of financing the scheme.

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* An amendment to the 1922-23 accounts was necessary after the accounts had been published and was given effect to in the 1923-24 accounts.

How the New Boats were Tested.

There is one aspect of the constructional scheme which calls for special comment. If it was difficult to find the perfect fishing boat, it was also difficult to find the perfect skipper! As the vessels were intended to serve as standard types of motor trawlers and drifters—or at least to serve as models from which such types could be designed—it was essential that they should be fished only by first class skippers, so that the results of their fishing operations might be a fair indication of the merits of the designs. The task of selecting suitable skippers was not easy, and it was decided in the first instance to place fishermen in charge of the vessels on probation and on the understanding that if they justified their selection they should have the option of taking over the vessels on a system of deferred payments spread over a period of ten years. In the meantime the Ministry retained ownership of the vessels and took its share of the profits according to the usual custom of the port. It was also agreed that the share of the profits earned by each skipper for the Ministry should be credited against the purchase price of that vessel if and when it was taken over by him. This concession was granted as an offset to the depreciation in the value of the vessels during the probationary period.

The skippers originally selected gave complete satisfaction in the majority of cases but economic conditions changed so greatly in the meantime that grave difficulties arose when the time came for the final transfer of the vessels. The constructional cost had been high and the delay in delivery considerable; fish prices had slumped far beyond expectation, whilst the price of oil, nets and gear had not fallen correspondingly. It was a big proposition to take over vessels at such figures and earn the amounts necessary to meet the half-yearly instalments of principal and interest together with the cost of insurance. After protracted negotiations three skippers elected to take their vessels over on the deferred payment system; two purchased outright on reduced terms for cash; the remaining four considered the task beyond their powers and abandoned the venture. Three of the four vessels thus returned to the Ministry have since been sold, whilst one is still fishing.

The financial results of the fishing operations are shown in the " Fishing Account " at the end of this chapter. The actual amount of the shares received by the Ministry was £1,598 10s. 8d., and the actual net cash expenditure £155 14s. 6d. The items for insurance and interest represent respectively the estimated cost of insurance at market rates and interest on cost of construction. The latter item would have been a charge on the Construction Account if the fishing operations had not been undertaken, so that it does not represent any additional charge incurred owing to the adoption of the fishing scheme. Moreover, vessels depreciate more rapidly when laid up than when in use. In fact the saving in this respect would more than counterbalance the net cash expenditure, and, be it added, the course followed by the Ministry had the advantage that it provided employment for men who might otherwise have been without boats or the means of working them, and enabled the boats to be satisfactorily tested under adequate supervision.

TRADING ACCOUNTS.

The attached Trading Accounts show the financial position on 31st March, 1923, in respect of the scheme for (a) loans for the installation of Motors in Fishing Vessels (Motor Loan Operations), and (b) the Construction and Disposal of Standard Fishing Vessels.

In the account dealing with the Motor Loan Operations the excess of expenditure over income—the term " income " for the purpose of this account including sums repaid and sums repayable, but still outstanding—was, on 31st March, 1923, £36,821 5s. 2d. This considerable figure represents the administrative cost of the scheme and interest on Exchequer issues. In the early years the amounts charged to the fishermen by way of loan represented merely the actual cost of the engine and installation and did not include charges in respect of the salaries, travelling expenses, &c., of the technical staff. It was a time of national emergency and the whole object of the scheme in its early stages was to increase the catching power of the inshore fishing fleets whose activities had at that time been little impeded by enemy action. At a later stage an addition was made to each loan in respect of these overhead charges but the number of loans granted after the alteration formed only a small percentage of the total.

The loss on the Construction Account (£9,579 4s. 5d.) is due to the fact that the vessels were required immediately after the war to meet the needs of fishermen discharged from Naval Service, and were therefore built at a time when constructional cost was at or near its highest point. The subsequent depression in the industry caused an astonishing fall in boat values, and in consequence it has been necessary to dispose of the vessels at a considerable loss. Needless to say, financial statements such as these take no account of the moral benefit resulting from the provision of these vessels at a time when boats of their size were practically unobtainable.

MOTOR LOAN OPERATIONS (FISHING VESSELS).

INCOME AND EXPENDITURE ACCOUNT FROM DATE OF INCEPTION (MARCH 1917) TO 31ST MARCH, 1923.

		£	s.	d.
To Cost of Engines, Installations, &c.		143,760	1	7
,, Expenses of Motor Loan Staff—				
Salaries and Wages	£9,223 7 2			
Travelling Expenses	5,718 17 10			
		14,942	5	0
,, Allowance for Headquarters' Administrative Expenses (see Footnote A)		7,065	0	0
,, Allowance for Insurance against Workmen's Compensation (see Footnote B)		57	0	0
,, Interest on Net Exchequer Issues (see Footnote C) ...		17,932	0	0
		£183,756	6	7

		£	s.	d.
By Loan Repayments and Interest to 31st March, 1923—				
Principal	£47,172 18 7			
Interest	6,018 11 10			
		53,191	10	5
,, Loans outstanding on 31st March, 1923	£50,504 19 11			
Add Interest accrued to 31st March, 1923	2,400 7 10			
		52,905	7	9
,, Initial Contributions by borrowers of amounts not included as part of Loan		5,486	9	7
,, Repayments of Insurance Premiums to 31st March, 1923		225	10	5
,, Insurance Premiums outstanding at 31st March, 1923 ...		558	3	0
,, Miscellaneous Income for goods supplied or services rendered		33,852	10	6
,, Sundry Stock on hand (including amount chargeable to Loan for which agreement had not been signed) at 31st March, 1923 (see Footnote D)		715	9	9
,, Excess of Expenditure over Income to 31st March, 1923, being loss		36,821	5	2
		£183,756	6	7

NOTE A.—Headquarters' Administrative Expenses based on actual salaries and travelling expenses of staff (where not charged direct to Motor Loan Subhead) with an addition to cover rent, rates, printing, stationery, Post Office services, &c.

NOTE B —Workmen's Compensation Insurance—Premiums charged at rate of 30s. per cent. on wages plus 10 per cent.

NOTE C.—Interest on monthly balances charged at 5 per cent. up to 31st March, 1920 ; afterwards at Bank Rate current.

NOTE D.—Stock on hand is valued at current market price.

STATEMENT SHOWING POSITION OF LOAN ACCOUNTS ON 31ST MARCH, 1923.

Loans Issued.		Total Amount of Repayments received to 31st March, 1923.		Loans Outstanding.		Loans completely paid off.		Loans in arrear at 31st March, 1923.		Repayments at 31st March, 1923, in advance of due.	
No.	Amount.	Principal.	Interest.	Principal.	Interest.	No.	Amount.	No.	Amount (including Interest).	No.	Amount.
	£	£	£	£	£		£		£		£
435	101,072	47,173	6,019	50,505*	2,400	147	25,370	214	21,897	66	1,380

* Exclusive of £3,394 unpaid principal in cases where boat and engine reverted to Ministry prior to 31st March, 1923.

CONSTRUCTION AND DISPOSAL OF STANDARD FISHING VESSELS.

Income and Expenditure Account from Date of Inception (June, 1919) to 31st March, 1923.

(1) *Construction Account.*

	£	s.	d.	£	s.	d.
To Cost of Construction of 5 Standard Motor Drifters—						
(a) Hulls, Spars and Ironwork ...	3,248	18	4			
(b) Ships' Fittings, &c.	1,169	6	7			
(c) Engines and Installation	3,671	3	1			
(d) Steam Sets, &c.	1,143	11	0			
(e) Carriage and Sundries	285	1	0			
				9,518	0	0
,, Cost of Construction of 3 Standard Motor Trawlers—						
(a) Hulls, Spars and Ironwork ...	2,524	17	9			
(b) Ships' Fittings, &c.	1,101	6	7			
(c) Engines and Installation	2,460	14	11			
(d) Steam Sets, &c.	752	18	8			
(e) Carriage and Sundries	193	2	1			
				7,033	0	0
,, Sundries not chargeable to construction				314	8	5
,, Proportion of Naval Architect's Salary				225	0	0
,, Workmen's Compensation Insurance (see Note 1) ...				12	0	0
,, Headquarters' Administrative Expenses (see Note 2) ...				835	19	10
,, Insurance on Vessels whilst laid up (see Note 3)... ...				11	8	4
,, Interest on Net Exchequer Issues (Construction) (see Note 4)				1,100	14	9
				£19,050	11	4

	£	s.	d.	£	s.	d.
By Sale of 2 Standard Motor Drifters for Cash	2,572	0	0			
Less Ships' Shares utilised as part purchase of Drifters (see Fishing Account below)	824	15	6			
	1,747	4	6			
,, Sale of 3 Standard Motor Drifters on Mortgage...	5,863	0	0			
				7,610	4	6
,, Interest accrued on Mortgages from July 1st, 1922, to March 31st, 1923				175	17	9
,, 3rd Party Claim received (damage No. 1 Drifter) ...				11	11	6
,, Interest accrued on P.O.S.B deposits				23	13	2
,, 3 Standard Motor Trawlers unsold (see Note 5) ...				1,650	0	0
,, Balance, being loss, transferred to Balance Sheet ...				9,579	4	5
				£19,050	11	4

(2) *Fishing Account.*

	£	s.	d.		£	s.	d.	£	s.	d.
To Cost of Repairs, &c., and Salvage Charges during fishing operations	237	3	3	By Net Ships' Shares credited to Ministry ...	773	15	2			
,, Headquarters' Administrative Expenses (see Note 2) ...	275	6	3	,, Do. utilised as part purchase of Drifters (see Construction Account above)	824	15	6	1,598	10	8
,, Insurance on Vessels, and Salvage Charges during fishing operations (see Note 3)	1,323	10	6	,, Credit from S I.F.V. Scheme for Salvage Work				22	10	0
,, Interest on Net Exchequer Issues (Fishing) (see Note 4)	1.665	6	1	,, 3rd Party Claim received (demurrage No. 1 Drifter) ...				58	18	9
				,, Balance, being loss, transferred to Balance Sheet ...				1,821	6	8
	£3,501	6	1					£3,501	6	1

NOTE 1.—Workmen's Compensation Insurance Premiums charged at rate of 30s. per cent., plus 10 per cent., on proportion of Ministry's mechanics' wages charged to construction.

NOTE 2.—Headquarters' Administrative Expenses based on proportion of actual salaries and travelling expenses of staff, with an addition to cover rent, rates, printing, stationery, Post Office services, &c.

NOTE 3.—Insurance during construction was borne by Contractors under terms of contract. Fire Insurance charged at rate of 14s. 6d. per cent. per annum for periods when vessels were laid up, and insurance charged at rate of 5 per cent. per annum (*i.e.*, loss and damage 3 per cent., fire 1 per cent., third party 1 per cent.) for periods when vessels were fishing. These represent the estimated amount of premiums which would have been paid had the vessels been actually insured.

NOTE 4.—Interest on Construction charged at 5 per cent. up to 31st March, 1920, afterwards at Bank Rates in force when respective payments were made. This has been charged to Construction Account whilst the vessels were building and laid up, and to Fishing Account for the periods the vessels were fishing. Interest on monthly balances on Fishing Account charged at Bank Rates in force from time to time.

NOTE 5.—The 3 unsold Motor Trawlers, which cost £7,033, are now valued by the Ministry at £1,650. This value is based on the market value of similar vessels at the present time, having regard to the price realised by sale of one of these vessels since the date of this account.

BALANCE SHEET AS AT 31ST MARCH, 1923.

LIABILITIES.

	£	s.	d.	£	s.	d.
Net Exchequer Issues—						
(a) Construction ...	14,454	11	3			
(b) Fishing ...	180	18	2			
				14,635	9	5
Headquarters' Administrative Expenses Account—						
(a) Construction ...	835	19	10			
(b) Fishing ...	275	6	3			
				1,111	6	1
Interest Account—						
(a) Construction ...	1,100	14	9			
(b) Fishing ...	1,665	6	1			
				2,766	0	10
Insurance Account (see Note 6)—						
(a) Construction ...	23	8	4			
(b) Fishing ...	923	7	4			
				946	15	8
				£19,459	12	0

ASSETS.

				£	s.	d.	£	s.	d.
3 Standard Motor Trawlers (at Market Value)							1,650	0	0
Sundry Debtors—									
(a) Construction—									
Mortgages on 3 Motor Drifters	£5,863	0	0						
Add Interest outstanding	147	5	3						
				6,010	5	3			
(b) Fishing—									
Balances in hands of Skippers ...				378	15	8			
Deposited in P.O.S B. by Skipper and not withdrawn at 31st March, 1923 ...				20	0	0			
							6,409	0	11
Income and Expenditure Account—									
Loss on Construction Account to 31/3/1923 ...				9,579	4	5			
,, Fishing ,, ,, ...				1,821	6	8			
							11,400	11	1
							£19,459	12	0

Note 6.—These items represent the premiums charged in the above accounts, less payments for salvage and repairs which would have been recoverable if vessels had been actually insured.

STATEMENT SHOWING POSITION OF VESSELS SOLD ON MORTGAGE.

Loans Issued.		Amount of Repayments Received to 31/3/23.		Loans outstanding at 31/3/23.		Loans in Arrear at 31st March, 1923.	
No.	Amount.	Principal.	Interest.	Principal.	Interest (Calculated to 31/3/23).	No.	Amount (including Interest).
3	£5,863	Nil	£28 12s. 6d.	£5,863	£147 5s. 3d.	3	£440 8s. 3d.

CHAPTER V.—INSURANCE OF INSHORE FISHING VESSELS.

Fishing boat insurance has passed through three phases in recent years:—(1) The pre-war period—when facilities at the larger ports were adequately provided by local societies, but were almost entirely lacking in the smaller ports. (2) The war period—when most of the local organisations broke down under the strain, and arrangements were made by the Government for relieving them to a large extent of their liabilities in respect of war risks. (3) The post-war period—which witnessed a return to pre-war conditions and the institution of a supplementary scheme operated by the Ministry and designed to afford similar facilities for insurance at those ports where no local societies existed or where the local organisation was inadequate or inefficient.

The arrangements made during the war were dealt with fully in the last Report* and it is unnecessary here to do more than to carry that Report on to the date when the schemes were brought to an end.

As has been previously reported, two distinct Government schemes were in existence, one for the steam fleets and the larger class of sailing craft, and the other for the inshore motor and sailing craft which ran risks of a different character from those of the larger sea-going vessels.

The War Risks insurance of the steam fleets was operated by the British Fishing Vessels War Risks Insurance Association under an agreement with the Board of Trade, by which the Government took 80 per cent. of the premiums and accepted liability for 80 per cent. of the claims. The total numbers and values insured of the vessels on the books of the Association on the 20th February in each of the years 1915 to 1920 were as follows:—

Date.	Steam Trawlers.		Steam Drifters.		Sailing Vessels.	
	No.	Value. £	No.	Value. £	No.	Value. £
1915	1,061	3,900,019	117	252.745	Not eligible.	
1916	647	1,835,200	144	126,573	No figures available.	
1917	527	1,820,439	358	367,885	106	94,175
1918	384	1,460,670	554	613,220	187	135,726
1919	485	2,086,503	298	498,475	110	96,642
1920	1,072	7,006,419	177	396,120	—	—

The total claims admitted up to 20th February, 1920, the date of termination of the scheme, amounted to £1,281,008 for trawlers, £65,798 for drifters, and £155,897 for sailing vessels.

The insurance of the smaller inshore vessels was undertaken by the Cornish Fishing Vessels Insurance Society, which was at that time the only active society whose operations were not confined to a single port and whose rates of premium were fixed at a level within the ability of the inshore fishermen to pay. By agreement with the Ministry and the Board of Trade the Society extended the scope of its operations to the whole of England and Wales in return for an indemnity against war losses. The reasons for this arrangement have already been set out in the last Report. The total cost to the Government from 1st April, 1917, when the scheme was initiated, to its termination was £6,916 10s. 8d.

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* *Fisheries in the Great War*, being the Report on Sea Fisheries for the years 1915 to 1918. (For particulars see cover.)

The particulars given above bring the history of the Government's War Risks schemes for fishing boats to a close.

Early in 1919, the Cornish Fishing Vessels Insurance Society gave notice of its intention to resume its original status as a purely Cornish institution. It was obvious that owing to this decision large numbers of fishermen who had, under the influence of war conditions, been brought to realise the benefits of insurance would shortly be left without reasonable insurance facilities, unless immediate steps were taken to fill the gaps in the chain of mutual societies round the coast. Indeed the word " gaps " is misleading, as the local societies were few in number and far apart, and although they existed at most ports used by any considerable number of fishing boats, their members formed but a small proportion of the total number of inshore fishermen boat owners round the coast. Moreover, as was pointed out in the last Report, these societies depended almost wholly on a system of levies which was liable to bring ruin to individual members in the event of a serious disaster.

As no organisation then existed which could undertake the work, the Ministry applied to the Treasury for permission to undertake the insurance of the smaller types of fishing vessels, taking over as a nucleus those boats already insured in the Cornish Society which would be excluded from it after its re-constitution on 1st July, 1919. The Treasury agreed to the proposal, and the first policies under the new scheme were issued on 1st July, 1919, so as to link up with the Cornish Society's policies which lapsed at that date. The rates of premium and conditions of insurance were the same as those previously offered by the Society, but have been revised from time to time in the light of experience. The scheme was supported by the Development Commission, which undertook at need to advance money on loan up to a maximum of £25,000—subsequently reduced first to £10,000 and then to £5,000. Interest at the rate of 4 per cent. was to be paid on any amount actually so advanced, and interest at the rate of ½ per cent. on the sum available at call was paid in return for the option.

It must be borne in mind that this was not a competitive scheme. It aimed at providing something which did not exist, but for which the need was urgent. It was an attempt to consolidate the financial position of the inshore fishermen by securing to them their capital, and it had this additional advantage that it provided some security for the Government's loans to fishermen for the installation of motors, which had been granted through the agency of the Motor Loan Committee. It is quite certain that, had the scheme not come into operation, considerable numbers of boats in which State funds were invested, would have been uninsured, or else the payment of exorbitant rates to private companies to whom this class of business offered no attraction would have seriously retarded the repayments of the instalments on those loans.

The scheme has therefore served a twofold purpose. It has secured money lent to the fisherman by the State, and it has provided the whole of the inshore fishing industry with the means of securing its capital. This last is in itself a sufficient argument in favour of the scheme, as the inshore fisherman is a national asset, and his gradual extinction would be a national disaster.

During the first nine months the scheme made rapid progress, and, although latterly the number of boats insured has shown signs of falling off, this is due more to the general industrial depression than to any decrease in the popularity of the scheme. The attached table gives an idea of the progress made during the three years and nine months to 31st March, 1923. The decrease in the values of the boats insured is accounted for partly by the general drop in values due to a return to more normal conditions, but more directly to the rejection of motor vessels of high value, for which other facilities were available, and which, being relatively few, involved a risk which was not adequately shared and therefore overloaded the scheme.

VESSELS INSURED.

Date.	Motor Boats.		Sailing Vessels.	
	No.	Value. £	No.	Value. £
1/7/19	168	68,550	82	49,200
31/3/20	242	117,120	78	57,710
31/3/21	261	107,147	68	53,725
31/3/22	237	86,332	53	38,735
31/3/23	251	85,557	45	27,940

So far as purely marine risks are concerned, the claim experience prior to 1922-23 was steadily satisfactory, but after about nine months there was an alarming increase in the number of serious fires on motor boats resulting either in total loss or very extensive damage. A similar increase was observed in Scotland and a warning on the subject has been issued by the Board of Trade. It seems probable that in the majority of cases the fires occurred as the result of the inexperience of the men in charge of the engines, and the improvement in the quality of petrol may also have contributed to some extent. The following table shows clearly the change in the situation brought about by fire losses :—

Year ending.	Fire Claims.			Ordinary Marine Claims.			Total.		
	£	s.	d.	£	s.	d.	£	s.	d.
31/3/1920	36	16	4	2,355	12	6	2,392	8	10
31/3/1921	5,286	6	4	2,348	9	5	7,634	15	9
31/3/1922	290	19	4	2,336	6	3	2,627	5	7
31/3/1923	2,176	0	2	5,129	14	7	7,305	14	9

The incalculable element introduced by the risk of fire had to be met by effecting re-insurances at rates which made it imperative to charge a separate premium to the fishermen for this class of insurance. This addition, coupled with the depression in the fishing industry caused many fishermen temporarily to cancel their policies.

Copies of the Trading and Profit and Loss Accounts are appended. From these it will be seen that mainly owing to the fire losses referred to previously there exists a deficiency of £5,142 9s. 0d. in the insurance fund, but the scheme has been safeguarded against further disasters of this nature by the re-insurances effected against fire risk on motor boats.

The marine experience in 1922-23 was the worst since the start of the scheme, and for the first time there was a loss on this class of business. The year was a bad one for underwriters generally and serves as a reminder of the uncertainty attaching to marine insurance. There is no reason to suppose that the average risk is greater now than in previous years, and as the profits previously earned on the marine section considerably outweigh the loss in the last of the years under review, the rates hitherto charged appear to be adequate.

INSURANCE OF FISHING VESSELS.

TRADING ACCOUNT FROM 1ST JULY, 1919, TO 31ST MARCH, 1923.

DR.	£	s.	d.	CR.	£	s.	d.
Claims paid and outstanding	21,369	0	2	Premiums Received	21,355	7	1
Fire Re-insurance Premiums	1,241	0	0	Fire Claim Recoveries	2,401	17	7
Reserve for Unexpired Premiums at end of year	1,091	16	10				
Balance in hand (before deduction of expenses of management, interest, &c.)	55	7	8				
	£23,757	4	8		£23,757	4	8

MANAGEMENT AND PROFIT AND LOSS ACCOUNT (1ST JULY, 1919, TO 31ST MARCH, 1923).

	£	s.	d.		£	s.	d.
Management Expenses	4,922	5	11	Gross Trading Profit	55	7	8
Interest to Development Commission (½ per cent. on amount of loan available at call)	243	15	0	Net Loss	5,142	9	0
Interest on Exchequer Issues (net) (Interest charged at current Bank Rate on cash overdraft from Treasury) ...	31	15	9				
	£5,197	16	8		£5,197	16	8

CHAPTER VI.—SCIENTIFIC INVESTIGATIONS.

INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA.

The greater part of the marine investigations conducted by the Department is carried out in co-operation with, and as part of the programme of, the International Council for the Exploration of the Sea. The last meeting of the Council before the war was held at Copenhagen in September, 1913. The war threatened to disintegrate the Council. Germany and the United States of America formally withdrew from participation, Belgium and Russia with Finland ceased during the war to contribute to the funds of the Council, and the end of the war found Russia in no condition to resume her connection with it. The only countries apart from Great Britain which continued to contribute to the central organisation were the four neutral countries, Denmark, Holland, Norway and Sweden. This, however, was sufficient to enable the organisation to be kept in being and the publications of the Council to be issued without interruption. In the conditions of the time the conduct of the Council's business was a somewhat thankless and by no means easy task. It was very successfully accomplished through the self-sacrificing energy of Professor Otto Pettersson, of Sweden, who, at the request of the participating countries, accepted the office of President, and of Commodore C. F. Drechsel, of Denmark, who continued in the office of General Secretary. They were greatly helped by the loyal co-operation of the small staff of the Central Bureau, all of whom agreed during the war period to perform their functions while voluntarily accepting reduced salaries. Thus, happily, the International Council continued to be a living and working organisation, and eventually, on the invitation of the British Government, re-assembled in full session in London on the 2nd March, 1920. The countries represented at this meeting were Belgium, Denmark, Finland, France, Great Britain, the Netherlands, Norway and Sweden. France was a new participant, and Finland was represented for the first time as a separate country. Mr. Lincoln Hutchinson, an Attaché of the American Embassy in London, also attended the meeting of the Council as a visitor.

After the opening meeting, at which Committees and Sections were formed, the Council settled down to the serious work of reconstructing its programmes, which embraced, as usual, studies of the hydrography of the sea, of plankton, of statistics and of food fishes. Committees and Sub-Committees were also formed and programmes framed for investigations of the plaice fisheries, of the herring fisheries, of eels and of salmon. In addition to the above, two interesting new departures marked this meeting of the Council. A Committee, called the South-Western Committee—which has subsequently been renamed the Committee of the Atlantic Slope—was formed to organise investigations of an area embracing the English Channel and the waters lying to the south and south-westward of the British Isles. The Council had long since recognised the necessity for extending its investigations into the Atlantic, and the various Atlantic expeditions organised by Denmark in consultation with the Council were in part an endeavour to meet this need. Hydrographical investigations by means of passenger and other ships in the Channel had been conducted by the Fisheries Department even before the war, and it was only the outbreak of war which prevented the realisation of a scheme elaborated by the International Council whereby the occasion of the opening of the Panama Canal and the assembling for the opening ceremonies of ships of all nations was to be seized for the purpose of a concerted study of certain Atlantic problems. The Fisheries Department had also long wished to undertake investigations in the Channel and to the south-westward with reference more particularly to the hake fisheries, which are of great importance to the ports of Milford, Cardiff, Swansea and Fleetwood. They gladly, therefore, embraced the opportunity afforded by the adhesion of France to the Council for the elaboration, in conjunction with France, of a scheme of investigations of the more important fishes of the south-west, particularly, in addition to the hake, pilchards, mackerel and tunny. The programme of the investigations was framed by the appointed Committee, and provided for co-operation between France and Great Britain and Ireland, Great Britain being represented by the Fisheries Department and the Marine Biological Association at Plymouth, and Ireland by the Fisheries Branch of the Department of Agriculture and Technical Instruction for Ireland. For the year 1920 a preliminary programme was framed, involving a careful hydrographical and biological investigation of the entrance to the English Channel. Having regard to the scarcity of equipment immediately available for research work at sea, this programme was of a comparatively modest character, and a considerable extension of it for the following year was anticipated, when it was hoped that the English Department would be in a position to send a research vessel to the area. This anticipation has, unfortunately, not been realised, owing to the need for national economy; but useful preliminary work has been done, and the programme has been further elaborated in subsequent years. A preliminary notice of the French work will be found in Publications de Circonstance, No. 74, "Travaux Océanographiques exécutés par la France dans l'Atlantique, été 1920," published by the International Council, and more comprehensive reports of subsequent work have recently been published by the Council.*

The other new departure was the formation of a Limnological Committee for the consideration of problems connected with the freshwater fisheries. At first sight the formation of such a Committee of a Council devoted to the exploration of the sea may seem to be out of place. It was, however, felt that certain aspects of investigations of freshwater fisheries would have a bearing upon the problems of the sea, and that it was therefore desirable that the opportunities created by the annual meetings of the International Council should be utilised for the purpose of discussing freshwater problems, and, if possible, organising some co-operation in their investigation.

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* Rapports et Procès-verbaux des Réunions, Vol. XXIX. Rapport Atlantique, 1921, and Vol. XXXI. Rapport Atlantique, 1922. (Andr. Fred. Host et Fils. Copenhagen.)

Subsequent meetings of the International Council have been held at Copenhagen in July, 1921, and in September, 1922, and at Paris in October, 1923. At the Paris meeting a new Committee, called the North Atlantic Committee, was set up under the convenership of Dr. J. Schmidt for the study of fishing and hydrographical problems in the area north of Rockall, which includes the important fishing regions of Iceland and Faroe.

The problem which, up to the date of the last meeting of the Council, has chiefly, though by no means to the exclusion of others, occupied the attention of the scientific staff of the Department has been that of the plaice fisheries. A brief account of the post-war plaice investigations will be found in a subsequent section of this chapter. The views of the Council regarding the conservation of the plaice fisheries are set out in the following Recommendations of the Plaice Committee and the resolution of the Council thereon.

The Plaice Question.

The Plaice Committee, after careful consideration of all material evidence presented to them since the meeting of 1921, reaffirmed its recommendations of that year in the following terms :—

" The Plaice Committee, having considered the results of investigations carried out by the English, Danish and Dutch investigators in the years 1919, 1920 and the beginning of 1921, and also those of German investigators recently published, are of the opinion that :—

1. The prohibition of fishing by steam trawlers and motor vessels of more than 50 h.p. in certain areas along the eastern and southern shores of the North Sea during certain parts of the year or the whole year would be the most effective method of protecting the plaice fisheries.

After having discussed Mr. Borley's scheme the Committee proposes that these areas should be :—

(a) A zone between the continental coast and 22 metres (12 fathoms) from 52° to 56° N. lat. to be closed during the entire year (inner zone).

(b) A zone between the inner zone and 27 metres (15 fathoms) from the latitude of Heligoland to 56° N. lat. to be closed, except during the months of April, May and June (outer zone).

They recommend the review of regulations based upon these proposals three years after their inception.

2. That in view of the proposals put forward in Recommendation 1, the question of an international size limit may be left in abeyance until the effects of the closure of areas have been determined by investigations directed to this end.

3. The Plaice Committee recommends transplantation of plaice on a commercial scale from some of the coastal grounds to the Dogger Bank. The Committee further recommends that the number transplanted in the first year of the operations should be at least a million plaice (about 100,000 kilogrammes), and that these should be caught by the ' snurrevaad ' and should be transplanted in well smacks, and that the plaice so transplanted should be kept under observation by marking experiments.

4. The Plaice Committee recommends the continuance and development of both biological and physical work directed to the further understanding of the ecology of the plaice and other general bionomics of the region.

5. The Plaice Committee recommends the prosecution of further researches directed to the development of efficient saving gear suitable for use in commercial fishing."

These recommendations were accompanied by an explanatory note which was communicated to the representatives of the fishing industry with the recommendations of the Committee and which it does not appear to be necessary to reproduce here.

The Report of the Plaice Committee in 1922, reaffirming its previous conclusions, was expressed in the following terms :—

" The Plaice Committee has considered the information which has been collected concerning the plaice fisheries of the North Sea during the year 1921. They are of opinion that this information affords definite evidence of a continued decline in the size and abundance of the plaice.

In these circumstances, while not minimising the difficulties involved in putting their proposals into execution, the Committee adhere to the recommendations which they submitted to the Council at the meeting held in July, 1921.

They would add that further reports published by German experts give reason to suppose that these investigators approve the measures proposed."

The Council, having received the Report of the Committee, passed the following Resolution :—

" The Council has considered the Report of the Plaice Committee annexed hereto, and finds itself in general agreement with the Committee's conclusions.

The Council is of opinion that there is clear evidence that the Plaice Fisheries may be seriously depleted by fishing operations, and especially by steam trawling, and that such depletion had already taken place before the war. As a result of the restriction of fishing imposed by the war the number of plaice of the larger categories in the North Sea greatly increased, but there is already evidence of a decline of the stock resulting from the resumption of intensive fishing.

The Council is convinced that the decline at present in evidence will, if existing methods of fishing continue to be employed without modification, be progressive, and that protective measures of restriction will become necessary in the near future. The Council accordingly recommends that regulations should be framed in accordance with the recommendations of the Plaice Committee, in order that the Governments concerned may be ready to act promptly and in concert in accordance with the necessities of the case. The Council strongly endorses the advice of the Committee that transplantation of plaice on a large scale should be undertaken. It further concurs in the advice of the Committee that any regulations involving the closure of areas to trawling should be reviewed three years after their inception. The results both of transplantation and of restrictive measures should be watched and controlled by scientific observations as closely as possible.

In recommending, subject to the above observations, the measures proposed by the Plaice Committee, the Council recognises that the enforcement of restrictive measures without the sympathetic support of the industry may present difficulties. Their practicability, however, appears to the Council to be a matter for the consideration of the Governments of the countries concerned. At present no course other than that recommended by the Committee presents itself to the Council as likely to procure the results required.''

This report being confined to matters directly affecting the sea fishing industry of England and Wales, room cannot be found here for a detailed discussion on the whole of the comprehensive programme of the International Council for the Exploration of the Sea. For further information reference should be made to the Reports of proceedings at the Annual Meetings,* to the Statistical and Hydrographical Bulletins. and to the occasional reports published by the Council.

THE GENERAL SCIENTIFIC WORK OF THE DEPARTMENT.

Resumption of Work, 1919.

The period immediately following the Armistice was one in which the sea fisheries of this country presented features which rendered it unique for this generation, possibly unique in an unqualified sense. The numerous ways in which the exigencies of war cut at the organisation, the material, even the very personnel of the industry, have been analysed and described in the last Report;† but to understand the importance of the effects of war conditions on the fisheries in the broadest sense, it is necessary to consider in addition to these effects on man and his activities the effect of such activities on the fish. The question must be approached in relation to the fish stock, where, paradoxically, the violence of war resulted in protection from capture on a vast scale; and the previous history of the stock, as far as commercial fishing and marine investigation have revealed it, must be borne in mind. It is unnecessary here to do more than recapitulate the various ways in which fishing was restricted by the war: in addition to the withdrawal for naval service of men and vessels there was the restriction of the grounds on which it was found practicable to allow the vessels to fish, and, a most important point, the absolute closure to fishing of grounds lying under marine mines. As it happened, all these conditions of a local or regional character bore far more upon the North Sea than upon any other region, and most upon the areas in the North Sea in which restriction of fishing might be expected to make a swift impression on the stock of fish.

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* Procès-Verbaux des Réunions, Vol. XXVI, 1918-1919 and 1919-20, Vol. XXVII, 1920-21, Vol. XXVIII, 1921-22, and Vol. XXXII, 1922-23.

† *Fisheries in the Great War*, being the Report on Sea Fisheries for the years 1915 to 1918. (For particulars see cover.)

Full weight must be given to this peculiar feature of the incidence of the protection afforded to the fish by the war. Of the regions fished by English and Welsh vessels the North Sea constitutes in area only about 19 per cent. Yet in 1913* half the fish landed in the countries of Northern Europe were drawn from it, and in the same year† nearly two-thirds of the number of direct landings by steam trawlers in English and Welsh ports were drawn from its waters. Of the whole of the demersal fish landed in these ports in the year mentioned—the last year before the war period—41 per cent. came from the North Sea, which produced also 93 per cent. of the drift-caught herring.

It will be seen that, though remarkably prolific, the North Sea was by 1913 very heavily and intensely fished. It is natural that this exploitation should bear more heavily on the demersal fish than the pelagic fish, since the latter are not, like the former, readily accessible to capture throughout practically their whole life.

The catch of a steam trawler for each day's absence from port in the North Sea was, in fact, in 1913 not particularly high as compared with that of other regions; it came ninth in the list† with 14 cwts., and had slowly and fairly regularly declined from over 18 cwts. in 1903, when the returns were first drawn up. These figures prove at least that the productive powers were not able to keep pace with the increase of fishing power, though they do not necessarily show a period of over-depletion to have been inaugurated. Lastly, the flat fish with their relatively restricted wanderings and accumulations of young stages on the Continental shallows, easily accessible to the trawl, are of all demersal fish the most vulnerable. It is precisely this intensely fished and important region in which fishing was most effectively restricted by the war, and precisely the shelving eastern portions of its bed that lay to the greatest extent under the effective protection of mines.

The heavy landings made by trawlers during the later years of the war and the large size of many of the fish taken was a universal matter of comment in the trade and was commonly ascribed to the effect of restriction of fishing. There can be no reasonable doubt that this opinion was in the main correct.

Such was the position at the conclusion of hostilities. The first task of fishery investigation was clear. It was to determine as thoroughly as possible the actual character and comparative density of population (under the new conditions) of the fish stock in the North Sea, but particularly of the chief food-fish taken with the trawl under the new conditions, and to do it before the effects of the revival of fishing were seriously felt.

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* *Bulletin Statistique des Pêches Maritmes, etc.* Vol. IX, p. 24.

† Annual Report on Sea Fisheries for 1913, Part II, Table Vb.

There were three purposes to be served. In the first place the efficacy of protective measures would in one sense be tested: that is to say, unless some very extensive improvement of stock were found to have resulted from the partial rest from fishing of the years of war, it would clearly be idle to expect beneficial results from the far feebler measures of regulation practicable in peace time. Secondly, it might prove possible so to analyse the effect of the restrictions imposed by war—closure of areas by mines, diminution of certain classes of vessel and the like—as to indicate the regulations most likely to prove adequate to protect the stock without excessive restriction of the industry. Lastly, unless the present conditions were adequately explored, there would be no firm datum from which to judge the effects of the post-war fishing, which was certain to become more intense, or the effects of any legislative intervention directed to ensuring the economical exploitation of the existing stock or to improving the supply.

Those who have followed even in a casual manner the development of fishery research during the pre-war decade in which it was seriously undertaken by this country will be aware of the many investigations entailed in the complete treatment of such an enquiry, and with a little thought will realise the nature of the staff and equipment required to bring them all to a successful conclusion. With both staff and material depleted by war, even below its inadequate pre-war condition, all that could be done was to commence as speedily and as thoroughly as possible such of the most directly serviceable researches as the means available permitted. While, however, it was thus impracticable to institute all the researches desired, the work of the year must be judged by its success or failure in dealing with the one pressing need of determining the character of the post-war stock in the North Sea.

The various branches of fishery research can be grouped under two main heads; namely, those involving the use of a ship or ships at sea, with their complement, a laboratory on shore, for the treatment of the material and records collected, and those dealing with the particulars of capture and quantities taken by commercial vessels, with their corollary, an adequate staff for the examination of the records obtained. Attempts were made to secure provision for both these main lines of work. In January, 1919, an application was made to the Treasury for moneys to be applied to the provision of adequate laboratory accommodation and suitable vessels, of which the sketch plans were already prepared. It proved impracticable, however, within the year to secure the financial support necessary, and thus no experimental sea work could be carried out, beyond the collection of samples of sea water and certain hydrographical data from the Mercantile

Marine.* The other branch of the work, fortunately perhaps at the moment the more essential, stood in better case. The statistical system was able to record satisfactorily, in the main, the quantity landed, and a statistical staff was available for the tabulation of the returns; while the sizes of the fish were investigated by detailed measurements made at sea on commercial fishing vessels.

The detailed measurement of fish on the markets had been undertaken on a large scale at the chief ports before the war. Commencing in 1903, plaice, haddock and cod had in turn been dealt with over a period of years. From 1912 to 1914 the examination of the herring trawling question had led to measurements of the herring and to some extent of other food fishes being carried out on trawlers and drifters on the fishing grounds.

The great advantages of measurements at sea over market measurements are (1) that the fish can be measured as caught, before any sorting into categories has taken place, (2) that a sample is obtained not only of the fish retained, but also of those rejected as too small for marketing, and (3) that accurate information as to the locality of capture is obtainable, which is not always the case with the market samples.

The proved success of this system of measurements at sea led the Department to initiate in February, 1919, similar investigations on commercial trawlers in the North Sea. A member of the scientific staff spent several months on this work, and a special staff of ex-Service men was engaged by degrees, and trained. Their duty was to measure adequate samples of the plaice, haddock and cod taken by trawlers, and to record full particulars as to the place of capture, the length of haul and other matters of interest. Special attention was devoted to the plaice. By the end of the year the ichthyometric staff had increased to eight, and many thousands of fish, including 155,623 plaice, had been measured. The records so obtained proved to be of very great interest, as showing in an accurate and detailed fashion the changes in size and abundance which the stock of these three important food fishes had undergone as a result of war conditions.

Plaice Investigations, 1920-21.

It early became apparent from a study of the measurements made at sea, and of the commercial statistics, that the war had had a clearly marked effect upon the plaice fishery. The average catch of plaice in those parts of the North Sea which were open to fishing in 1919 was about double the pre-war figure, and the proportion of large fish had very greatly increased. Small plaice, on the other hand, were scarce or absent on many of the grounds on which they had been abundant before the war. These preliminary results of the ichthyometric work carried out in 1919 were so striking that the Department resolved to devote all the energies of its scientific staff to an intensive study of the plaice during a complete year. This was the more important because the question of regulating the plaice fishery in order to avoid eventual depletion of the stock, a matter on which international agreement had almost been reached when war broke out, had been raised again immediately after the war, especially by the Danish delegates on the International Council, who expressed the view that advantage should be taken of the increased abundance and size of the plaice to impose an international size-limit of 25 cm. The Department, for various reasons, demurred to the acceptance, without further inquiry, of this proposal, and at the meeting of the International Council held in London in March, 1920, the British delegates were successful in carrying their own proposal that a year's work on plaice should be carried out by all the countries having important plaice fisheries in the North Sea, in order that the full significance of the changes due to the war might be elucidated. A co-ordinated programme of work was drawn up at the meeting, and participation promised by England, Scotland, Ireland, Denmark, Holland, Belgium and France.

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* *A Report on the Hydrography of the area centred on 50° N., 20° W.*, by Dr. E. C. Jee, was published in 1919. (Fishery Investigations, Ser. III, Vol. III, Part I, price 2s. 6d.)

A Report on the Hydrography of the North Sea from the River Tyne towards the Naze of Norway, by Dr. E. C. Jee, was published in 1920. (Fishery Investigations, Ser. III, Vol. IV, Part I, price 12s.)

The Department took immediate steps to increase its staff of fish-measurers, and to place a number of them during the summer at certain inshore ports on the south and west coasts, where it seemed likely that the effect of a high size-limit would be to destroy the local fishery. In the Irish Sea the direction of the work was in the capable hands of Professor James Johnstone.

At the beginning of the year the Department was in negotiation for the purchase and equipment of an Admiralty trawler as a fishery research vessel, but as this scheme was not likely to materialise in time for the plaice investigations, a vessel was chartered temporarily for the purpose and run successfully from May, 1920, to April, 1921. The vessel in question was the "Joseph and Sarah Miles," a trawler belonging to the Royal National Mission to Deep Sea Fishermen. The researches carried out by means of this vessel included the marking of a large number of plaice on the Dutch inshore grounds, and on the Leman and Flamborough grounds, and the transplantation of 1,240 plaice to the Dogger Bank. Samples of plaice were trawled in May and September along a continuous line from the Haaks Light Vessel outwards towards the English coast in order to obtain material upon which to study the age and growth-rate of the plaice in comparison with the results obtained in previous years. During the winter months a very complete survey was carried out of the spawning grounds of the plaice, particularly in the Southern Bight, in order to estimate the total number of eggs produced and compare it with the number found in 1910-11 and 1913-14.

Repeated trawling experiments were carried out at certain fixed positions which had been studied before the war, and also at many other positions, all the plaice being measured, and the age and state of maturity of a proportion of them being determined—the age by examination of the otoliths or ear-stones. The work on age and maturity was supplemented in the winter of 1920-21 by the examination of numerous samples landed by commercial trawlers at Lowestoft. In April, 1921, an extended test was made of the

" savings-trawl " invented by the late Captain Ridderstad of the Swedish Navy. This trawl was so designed as to permit of the escape of undersized flatfish.

In addition to the fish-measuring at sea and at the ports and to the investigations on board the research vessel, a comprehensive programme for the study of the hydrography of the southern part of the North Sea was inaugurated and successfully carried through, terminating in September 1921. This involved the taking of temperatures, of samples of sea-water for salinity determination, of wind and current observations, and the liberation of several thousand drift bottles at regular intervals throughout a year. This work was carried out for the Department by the staffs of a number of light vessels in the southern North Sea.

The year's study of the plaice fishery was accordingly carried out in full in accordance with the programme laid down at the International Council meeting, and certain definite conclusions were then arrived at as to the influence of war conditions upon the stock, which may be summarised as follows :—*

1. *Actual Abundance.*—(i) During the war the abundance of plaice had greatly increased.

Landings and catch per day's absence of steam trawlers before and after the war were :—

	1913.	*1919.*	*1920.*
Landings in *cwts.* ...	349,476	427,649	591,387
Catch per day's absence in *cwts.* ...	2.1	4.5	3.4

The fall in the catch per day's absence in 1920 may be due in part to the sharing of the total catch made among a greater number of vessels.

(ii) The large and medium categories had greatly increased during the war, while the small had greatly decreased. It must be remembered that market categories are not always the same, and the present tendency to include among the small and medium, plaice which before the war would have been classed as medium and large, respectively, causes the increase in proportion of large and medium to appear less than is actually the case. In 1920 as compared with 1919 small had increased, as had large, while medium had decreased. Resumption of fishing thus appears to have affected medium plaice first.

	Landings in cwts.			*Percentages.*		
	1913.	*1919.*	*1920.*	*1913.*	*1919.*	*1920.*
Large ...	98,644	183,857	269,741	20.3	37.8	41.0
Medium ...	157,194	263,589	247,532	32.4	54.3	37.6
Small ...	209,293	36,640	97,601	43.1	7.5	14.8

2. *Change in Size.*—(i) Owing principally to the work of research vessels it is possible to compare the size of the North Sea plaice in pre- and post-war years. In 1910 the average size of fish in the open

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* A Summary Report on these investigations, entitled *The Plaice Fishery and the War*, has been published in Fishery Investigations, Series II, Vol. V, No. 3.

sea was definitely shifted to a higher value. The smaller fish of pre-war years were absent from grounds on which they had predominated; larger fish than usually met with since 1900 were fairly common; and the sizes making up the majority of the catch were also higher. Roughly the plaice taken from the central grounds of the southern North Sea were 10 cm. (nearly 4 inches) longer in 1919 than before the war; (ii) in 1920 the size on the whole was less than in 1919. The largest plaice were not affected in this change, but the middle sizes made up a less proportion of the whole than in 1919 and the smallest plaice a greater proportion.

3. *Proportion under 25 centimetres.*—The International Council had considered this length a desirable size-limit before the war. It was necessary, therefore, to find what proportion of the catch would have to be thrown over if caught, were such a limit now in force. In the North Sea this proportion was so low that the grounds fished would clearly none of them be avoided as unprofitable, even considering plaice alone, while some inshore plaice fisheries would be practically killed by such a limit.

> The proportion by number below 25 cm. varied in different parts of the North Sea, but except in coastal waters never reached 1 per cent. by number in 1919 or 10 per cent. in 1920, and was usually less than half this proportion. By weight the percentages would be very much lower. In three South Coast ports, with mainly inshore fishing, the percentages were 27 per cent., 54 per cent. and 67 per cent., while in the Irish Sea similar or even greater percentages were found.

4. *Age and Growth Rate.*—(i) The older fish constituted a far greater proportion of the catch after than before the war; the young fish were found closer to the coast than usual, as if unable to get to sea. The great abundance found after the war was thus due very largely to the accumulation of fish suitable for market but uncaught.

> This was particularly shown by the great increase of plaice in their eighth and subsequent years of life. The plaice of the commonest ages to be brought to market were centred ten miles or more nearer shore than was the case before the war.

(ii) The plaice were smaller for their age than before the war. The increase of numbers had thus been accompanied by a slower rate of growth, presumably owing to the competition for food. Thus a very great restriction of fishing may slacken the rate of production of plaice fit for the market.

> In the area from Holland to Leman Ground the rate of growth fell by about an inch to two inches a year, according to age.

(iii) The plaice were found to reproduce first at a year later in their life than before the war.

5. *Transplantation.*—Plaice transplanted from Dutch coastal grounds to the Dogger Bank grew, as before the war, at a very much more rapid rate than those left near the coast. There was little,

if any, variation of the high rate of growth found in each of the years 1905-9. Thus the increase of plaice population on the Dogger during the war had not lessened the desirability of commercial transplantation, nor, it is concluded, would any increase of population brought about by the operations advocated.

> Plaice were transplanted in June, 1920. In April, 1921, they had grown 9.3 cm. (nearly 3¾ inches), while those on the coast had grown 3.1 cm. (about 1¼ inches). In a year they had grown 13.7 cm. (nearly 5½ inches). The growth in weight was remarkable; the transplanted fish gave every indication of having benefited to much the same extent as those ferried out before the war, which in a year reached about 4½ times their weight on liberation, while those left on the coast had only about doubled their weight.

6. *Savings Gear.*—Experiments carried out with a trawl designed to permit the escape of small flat fish showed that it fulfilled its purpose, but was of a type unsuitable for use in commercial trawling in the North Sea.

7. These conclusions in their broadest terms can be summed up as follows:—

(i) North Sea plaice is more abundant than before the war chiefly owing to the accumulation due to restricted fishing.

(ii) The older plaice are more abundant accordingly, and the younger and smaller are restricted to grounds nearer the coast than formerly.

(iii) This distribution, together with a slackening of growth rate, points to overcrowding; which, however, has not materially affected the growth of transplanted fish.

(iv) A change in the direction of return to pre-war conditions, however, has commenced.

(v) A complete return to pre-war conditions is in the interest neither of the plaice fisheries nor of the food supply, since under these conditions the region was not doing its best in the production of plaice as food. It is necessary therefore carefully to examine any measures suggested for plaice protection.

(vi) A size limit would be most prejudicial to certain inshore fisheries and at present without material utility in the open North Sea, where, moreover, it might result in waste of foodstuff.

(vii) Transplantation to the Dogger Bank on a commercial scale is desirable; it involves no restriction of industry.

(viii) The chief aim of any measure regulating the fishery should be the protection of large numbers of plaice during their most rapidly growing years, that is when at lengths about from 20 to 25 cm. This could clearly be accomplished by

> restricting fishing in the areas in which these sizes predominate, though the desirability of such restriction must be determined by an estimate of total gain and loss.

The recommendations made by the Plaice Committee on the basis of these and other investigations are set forth on pp. 63-64.

Reorganisation of Staff and Installation at Lowestoft.

A very necessary and long overdue increase in the scientific staff took place in the course of 1920, when six appointments were made to the new grade of Probationer Naturalist, and a general regrading and reorganisation of the staff was carried through. In the same year premises were secured for a fisheries laboratory at Lowestoft, and partially equipped for the work. The majority of the scientific staff were transferred to the laboratory in October, 1920. The complete equipment of the laboratory, including the provision of tanks with a circulation of sea-water, has been unavoidably postponed for reasons of economy.

Provision of Permanent Research Vessel.

In 1920 the Mersey trawler " George Bligh " was purchased from the Admiralty, and the work of converting her for research purposes was put in hand. It was originally intended that she should be used in the waters off the south-west coast for the study of the mackerel and the hake fisheries and a survey of the hydrography of this important area. A second research vessel for the North Sea was contemplated, and enquiries were being prosecuted for a suitable vessel of moderate draught, when it was decided on the grounds of economy to make shift in the meantime with one vessel, which would be devoted mainly to work in the North Sea. The full programme of research in the S.W. area which had been drawn up in consultation with the Irish and the French fishery authorities had accordingly to be abandoned.

The reconditioning of the " George Bligh " was completed in March, 1921, and she sailed in April from Hull on the second of the exploratory voyages to the Lousy Bank of which an account is given below (pp. 80-81).

On her return from this cruise at the end of the month she was laid up until the charter of the " J. and S. Miles " expired at the end of May. Owing to the delay occasioned by the coal strike she did not commence her regular North Sea cruises until July, 1921. Since that date she was at work regularly until December, 1921, when she was laid up for two months in the interests of economy. She has proved to be a powerful ship of excellent sea-going qualities.

The Study of the Fish Food on the Sea Bottom, 1921.

The first line of investigation taken up with the new ship was the quantitative study of the fish food found on the bottom. Of equal or even greater importance than the plankton as a source of fish food are the animals which live on the sea bottom or buried a few inches in it, for they constitute the food of the demersal or bottom-haunting fish. Until the Danish fishery investigator, Dr. C. G. Joh. Petersen, invented his bottom-sampler or "grab," which is devised to capture all the animals living on or in a patch of bottom of a definite area, no instrument existed by means of which a quantitative estimate could be formed of the total number of animals on any given area of the sea bottom. Much work had been done prior to 1910, particularly by English investigators, on the bottom fauna of the North Sea, by the use of various forms of dredge. A qualitative survey was carried out the results of which will, it is hoped, ultimately be published. But the dredge does not give a true picture of the quantitative abundance of the different animal forms, particularly the smaller animals which live buried in the sand, since many of these animals get washed out of the net as it is hauled. Furthermore, it is impossible to say what area of the bottom a dredge traverses in the course of each haul, so that no general quantitative results can be expected from its use. The bottom-sampler invented by Dr. Petersen resembles in its latest improved form those large dredger-grabs which may be seen in many harbours, but it is of course a very much smaller instrument. Like the dredger-grab it is designed to bite out a piece of the bottom and bring it up as a whole. It consists essentially of a pair of large, deep jaws hinged together, which can be held open as the grab is let down to the bottom. When it touches the bottom a catch is released and the strain is taken by a chain which passes round a fixed roller inside one of the jaws, so that when the grab is raised the two jaws come together, enclosing a sample of bottom and bringing it up intact. When brought on board the sample is washed through a series of wire sieves and all the living animals are picked out and preserved, to be identified, counted and weighed on shore. The type used by Dr. Petersen in the Danish belts and fjords brings up a sample of a superficial area of 0.1 of a square metre. It has been found preferable for work in the open North Sea to use a grab double this size, which delves rather deeper into the soil and brings up an area of 0.2 of a square metre or approximately 2 square feet. This can be used satisfactorily in calm or moderate weather, but in bad weather the drift of the ship prevents a vertical pull on the grab and tends to capsize it on the bottom. Even the grab is by no means a perfect instrument and does not give a completely representative sample of the animals living on the bottom. In the first place it rarely catches in anything like their natural abundance the freely moving animals such as shrimps and crabs which are able presumably to see the grab coming down and to get out of its way. In the second place, the grab does not dig deep enough to take some of the larger shell-fish such as the razor-shell which can burrow with lightning rapidity to depths where the grab cannot reach them. Frequently the ends of these shell-fish are found in the grab, obviously broken off as the grab closed upon the disappearing shell-fish. Fish too, find some difficulty in capturing the adult razor-shell, and often they manage to bite off only the foot of the shell-fish, before it dives down deeper into the sand. A third drawback is that the grab cannot be used on rocky or stony ground. It is unsatisfactory even on gravel, as the jaws are often prevented from closing completely if a small stone is caught between them. In spite of all these drawbacks the grab has given extraordinarily good results on the whole so far as concerns those animals which live buried not too deeply in the bottom-soil. The small shell-fish and worms found in this layer are almost all important as fish food, and, roughly speaking, what the grab cannot catch in the way of burrowing animals the fish cannot catch either. Dr. Petersen has been using the grab for many years in the waters of the Western Baltic, the Belts, the Kattegat and the Skagerak and he has been able to chart out the distribution of all the commoner forms. He has found that different areas, and, especially, different depths, are characterised by particular groups of animals associated together. These associated and typical groups he calls "communities." One of the commonest in water of moderate depth is the *Venus* community, so called from the name of a bivalve shell-fish which is the most typical form found in it. Other communities are known by the name of the particular kind of sea-urchin or starfish which is the most notable animal occurring in them. These investigations have thrown a great deal of light upon the scientifically interesting question of what factors govern the distribution of bottom-animals. From the Fisheries standpoint, however, certain other results of Dr. Petersen's work are of more importance. He regards it, and rightly, as a matter of the greatest importance to estimate the quantity of food which is available for bottom-living fishes on any given ground. He found, for instance, that the reason why the young plaice did not grow in the seaward portion of the Limfjord was that the food supply was short, and he was able to remedy this by transplanting them in millions further up the Limfjord where food was more plentiful. His bottom-sampling work has, therefore, a very practical side to it, for one of his principal aims has been to obtain some idea of the actual quantity of food available for the fish in Danish waters. This is estimated in terms of so much dry organic weight per square metre. One remarkable and important result which he obtained was that the quantity of any particular fish food might vary enormously from year to year, one year being rich in it, the next perhaps very poor. He demonstrated, that is to say, large annual fluctuations in the stock of food, just as Hjort and others have shown fluctuations in the stock of herring, cod and other fish.

Apart from a few samples taken by Petersen and Hjort off the western coast of Denmark, the first extended use of the grab in the open North Sea was that made by the Department during the second half of 1921. A preliminary survey was carried out in July by the "George Bligh" under the direction of Dr. H. Blegvad, Dr. Petersen's assistant, during a cruise from Lowestoft to Esbjerg. A number of Dr. Petersen's communities were recognised, and his forecast as to what communities would be found in the southern North Sea was in part confirmed. A report on this cruise has been made by Dr. Blegvad and published by the Zoological Society of London.*

During the autumn attention was concentrated on an area 30 miles square in the centre of the Dogger Bank, which was traversed on several occasions by a network of stations. The object of this work was to determine the approximate amount of food for plaice and other fish normally present on the Bank. It is intended to repeat the observations periodically to determine what seasonal and annual variations in amount may occur, and to extend the observations to one or two other plaice areas in order to compare them with the Dogger Bank. These observations will become of great practical importance if, as is hoped, transplantation of plaice to the Dogger is carried out on a commercial scale. It will obviously be necessary to make sure that enough food is available for the increased population. Hauls with the grab are also made on most ordinary cruises of the "George Bligh" in order to accumulate knowledge by degrees which will make it possible to map out the distribution of the communities in the North Sea.

One striking feature of the results obtained on the Dogger is that the occurrence of the bottom animals is very patchy. Certain hauls are extremely rich, others not very far off may be quite poor. This fact was already known in a general way and it adds to the difficulty of arriving at any estimate of the total quantity of food in the area.

Herring Investigations, 1921.

Work on the herring was resumed in the autumn of 1921 in accordance with the programme of research laid down at the International Council Meeting in July, 1921. Special attention was devoted to the study of the spawning areas and the distribution of the larval stages of the herring. Search for herring spawn led to negative results, but the collection of the early floating stages was successfully carried out in many parts of the North Sea south of the Dogger, and rich material for study obtained.

In order to throw light upon the unusual scarcity and poor condition of the herring in the summer and autumn of 1921 a special hydrographical cruise was carried out in October, passing through the main fishing grounds and across the North Sea north of the Dogger Bank. The observations then made on the temperature and salinity of the water demonstrated the presence on the bottom north of the Dogger of an abnormally large amount of water of Atlantic origin. It is certain that abnormal hydrographical conditions prevailed in the North Sea during this year (see also pp. 78-79 below), and it is probable that some connection exists between these abnormal conditions and the relative failure of the herring fishery. What the connection, if any, is, cannot be stated at present, but it is being made the subject of further research. The results obtained in 1921 have been communicated in three short papers published by the International Council.*

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* *Animal Communities in the Southern North Sea.* Proc. Zool. Soc., 1920, pp. 27-32.

In the years before the war much attention was directed, as is indicated in the Annual Reports for 1912, 1913 and 1914, to an investigation of the alleged evil effects of the practice of trawling for herring. The Report on these investigations was completed in 1915, but, owing to a variety of circumstances arising out of the war, publication was unavoidably delayed and the Report did not appear till 1922.† It contains a full description with illustrative charts of the English herring fishery of 1913, and an examination and discussion of the extensive data obtained at sea during the special investigations carried out in 1913 and 1914. The conclusion is reached that the case against herring trawling is not proven and that legislative restriction of this practice is not at present called for.

Cod Investigations, 1921.

At the meeting of the International Council in July, 1921, a comprehensive programme of research on cod and haddock was drawn up, and an agreement was made between Scotland and England that the former should concentrate on the haddock, while England should specialise in cod investigations, arrangements being made for the mutual interchange of material and data.

In this year a beginning was made with several lines of investigation on the cod. Thus the statistics and measurements made at sea since the war have been studied, in order to ascertain the effect of the war upon the stock, but the results obtained are difficult of interpretation. A report on the market measurements of cod made in 1912-14 has been prepared and published.‡ It includes a survey of the fishery during the years 1903-1914. Measurements of cod were made on the research vessel and samples of scales taken for age determination. In December experiments in marking cod were begun at Flamborough, in Yorkshire, the material being obtained by a member of the scientific staff working on board a local coble.

Eel Investigations, 1921.

England's share in these investigations has been limited to supplying material to Dr. Johs. Schmidt, the eminent Danish scientist who is in charge of these researches, and in assisting him in other ways. Several large samples of eels from different parts of the country have been despatched to Dr. Schmidt, as well as samples of elvers from Epney. In connection with Dr. Schmidt's researches in the Atlantic on the Danish research vessel, " Dana," the Department was asked to arrange for certain observations to be made in the Straits of Gibraltar. An observer was accordingly sent to Gibraltar in the spring of 1921 where he carried out experimental hauls on board a destroyer which was put at the disposal of the Department by the courtesy of the Admiralty. No eel larvæ were found on this occasion though other interesting planktonic forms were caught. Some hauls made subsequently by the officers of one of H.M. ships gave interesting results.

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* *Notes on the Atlantic Plankton taken off the East Coast of England in 1921 and 1922*, by A. C. Hardy. *Investigation of Non-tidal Water Movements North of the Dogger in October, 1921*, by J. N. Carruthers. *The Salinity and Temperature of the Southern North Sea and English Channel during the period 1920-21*, by J. R. Lumby. Publications de Circonstance, Nos. 78, 79 & 80, 1923.

† J. O. Borley and E. S. Russell.—*Report on Herring Trawling*, Fishery Investigations, Series II, Vol. IV, No. 4, 1922.

‡ *Report on Market Measurements in relation to the English Cod Fishery during the years 1912-14*, by E. S. Russell.—Fishery Investigations, Series II, Vol. V, No. 1, 1922.

Hydrography, 1921.

Immediately after the meeting of the International Council in July, 1921, a programme of work on general hydrography was drawn up to give effect to such of the recommendations of the Hydrographical Section as concerned the Department. These comprised the installation of Jacobsen current meters on the Varne and Smith's Knoll Light Vessels, and the making of arrangements for daily observations of temperature and salinity to be taken on these vessels. These arrangements were completed in time for the work to commence on 1st January, 1922. During the latter half of the year the system of obtaining records of temperature and salinity on steamship routes was reorganised, redundant routes were discontinued and negotiations begun for new routes to be sampled across the Irish Sea and the Atlantic Ocean. Investigations were made on the hydrogen-ion-concentration and the oxygen-content of the water in various parts of the North Sea. A densimeter invented by Dr. Hans Pettersson for the direct reading of densities was tested at sea on the research vessel and on lightships. The results of the intensive year's work on the drift of the surface and bottom waters of the southern North Sea, which was undertaken in connection with the plaice investigations, and was not concluded till September, 1921, were subjected to careful study, particular attention being directed to the influence of the wind upon the movements of the water.

As distinct from the outline programme of general hydrography undertaken at the instance of the Hydrographical Section of the International Council, the hydrographical work on the " George Bligh " has been carried out in direct connection with the fishery problems studied, in accordance with the proposals of the French delegates regarding hydrography which were carried at the 1921 meeting of the Council. An instance of this sort of " fishery hydrography " is the special hydrographical cruise carried out in connection with the herring investigations, to which reference has been made above (p. 76). Other work of this nature has been directed towards ascertaining the hydrographical conditions obtaining on the spawning grounds of the herring.

The year 1921 was in many respects an abnormal one hydrographically.

As far as the southern area of the North Sea is concerned, it appeared that the salinity generally had been exceptionally high. "Atlantic water" (*i.e.*, water over 35°/oo salinity) was found to have entered this area in January and February, extending in a north-easterly direction as far as latitude 53° N. Lightship observations indicated that this flooding began in the early winter of 1920, and mean monthly salinities showed a general increase up to May in the north and to March and April in the south. There was a tendency for these latter values to rise in September and October.

As regards temperature it was noteworthy that the winter minimum temperature appeared to have been reached slightly earlier than usual, but differed little from the usual minimum temperatures. The summer maximum in the same way was slightly earlier than usual. In the north the yearly range was small, and in the south the summer temperatures were about 1° C. higher than usual.

North of the Dogger Bank the surface observations made on the Shields-Christiania route showed that this line passed through Atlantic water nearly the whole year. This water was present also in the latter part of 1920. Only twice before does it seem to have been recorded that Atlantic water crossed this line, viz., in 1912 and 1905.

Temperatures for the summer did not appear to be higher nor those for the winter lower than usual.

In October the bottom area in the deepest parts of a line, Scarborough—Great Fisher Bank, was found to be flooded with water over 35°/oo up to 40 metres from the surface, the bottom temperatures being 1° C. higher than usual.

Only a very slight extension of the fresh water current from the Skagerak to the westward appears to have taken place, and that rather earlier than usual.

Plankton, 1921.

The plankton investigations have been reorganised in order to make them of more direct utility in the study of fishery problems. No attempt has been made to carry out a general survey of the distribution of plankton; attention has been concentrated rather upon its importance as fish-food. A beginning was made with the study of the planktonic food of both young and adult herring, and this important line of work is being continued. Similarly, plankton samples were collected systematically during the plaice-egg cruises carried out in the winter of 1920-21, in order to throw light upon the question of the amount of food available for the larval plaice. A report on this has been completed and published.*

Plankton observations carried out on the special hydrographical cruise and on other cruises in the autumn of 1921 gave interesting results confirmatory of the conclusion drawn from the hydrographical data that an abnormal influx of Atlantic water into the

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* *The Macroplankton of the Plaice Egg Cruises, 1920-21*, by R. E. Savage.—Fishery Investigations, Series II, Vol. V, No. 6, 1923.

North Sea had taken place. Enormous quantities of the pteropod (a small pelagic mollusc) *Limacina lesueuri* and a few of the allied genus *Peraclis* were found in certain parts of the Atlantic water; both of these are Atlantic forms and have never previously been recorded in the North Sea. *Limacina retroversa*, a pteropod which is usually present in only small numbers in the North Sea, but which is very abundant off the west coast of Ireland, was also found in large numbers. The Atlantic radiolarian, *Acanthometron quadrifolia*, which swarms in the Gulf Stream, and has hitherto only rarely been found in the North Sea, was found in great abundance at three points where Atlantic water was indicated. In addition, the medusæ (jellyfish), *Tima Bairdii* and *Slabberia halterata*, were found to be common. The former is usually only met with off the coast of Scotland, and the latter is a rare form found on the south coast of Ireland and in the Channel.

It is interesting to compare the above results with those found by Bygrave in the Channel in 1905 and 1906.* In 1905, which, like 1921, was a poor herring year and also marked by an abnormal influx of Atlantic water, a swarm of *Limacina retroversa* came into the Channel for the first time, followed in 1906 by a swarm of *Limacina lesueuri*, which was the first record of its occurrence north of the Bay of Biscay.

Exploratory Voyages, 1920-21.

In the summer of 1920 the Department sent out a vessel, the steam trawler "Nicholas Dean," lent by the Admiralty, to survey the Lousy Bank and to report whether trawl fish could be caught in paying quantities upon it. This Bank, which lies between Faroe Bank and Rockall, had already been discovered by fishermen and was worked to some extent by liners, but little was known about its exact position and extent, or about the depth of water, the nature of the bottom, and its suitability for trawling. On this cruise in 1920 the Bank was surveyed and charted. Taking the 200 fm. line as giving the limits of the Bank, it was found to be 34 miles long by 18 broad and to lie in a direction E.N.E.—W.S.W. (mag.). The least depth of water was 108 fms., over an area of about 2 square miles, the centre of which lay at the position lat. 60° 25′ N., long., 12° 37′ W. The depth all round the Bank increases suddenly outside the 200 fm. line. As regards the nature of the bottom, the Bank can be divided into two parts. The part which lies to the westward of 12° 24′ W. long. is uneven and rather rough, and consists of fine white sand and shells, with black specks and coral (probably in patches). In this part of the Bank small black stones are found in depths of less than 140 fms. To the eastward of the line mentioned above the bottom is fine and even and there is no coral. Small black stones occur here in the N.E. part of the Bank. On the southern half of the Bank sponge is common, especially the "Elephant's Lug" sponge.

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* *The Plankton of the English Channel in 1906*, by W. Bygrave.—International Fishery Investigations, 3rd Report (Southern Area).

The results of trawling upon the Bank were unsatisfactory. In 11 trawl hauls of about 2½ hours each few fish of any value were caught. The most abundant fish was the soldier or Norway haddock (*Sebastes*) which averaged about 100 per haul. Tusk averaged 28 per haul and bastard ling 9 per haul. Only 32 halibut were caught in all.

In the hope that fish might be found on the Bank in greater quantities in the spring, the Ministry's new research vessel, "George Bligh," was sent out in April, 1921. It was also hoped that other banks might be found in the neighbourhood of Rockall which could be surveyed and fished if weather permitted. Eight hauls were taken with the trawl on the Lousy Bank and the biggest catch was about 30 tusk, two baskets of "soldiers" and a few oddments amounting to half a basket. The soldiers are viviparous fish, that is to say, unlike the majority of fish, the young are born in an advanced state of development. The breeding season was at its height. Only 2 halibut were caught on the Bank. The bottom appeared to be less suitable for trawling than was thought on the first voyage. The whole of the western and south-western sides of the Bank was found to be rough with coral, the trawl being torn badly several times, and on one occasion the net was carried away completely. The smoothest ground appeared to be in the N.E. corner in 150-160 fathoms. A least depth of 95 fms. was found 3 miles N.E. (mag.) of the 108 fms. patch discovered in the first expedition. A strong E.S.Easterly set was experienced on the N.E. corner of the Bank. The bank reported to the N.N.W. of the Lousy Bank did not appear to exist.

In making soundings between Lousy Bank and Rockall a bank some 10 miles by 10 miles in extent, carrying a depth of 260 fathoms, was found centering in lat. 58° 52′ N., long. 13° 46′ W., that is to say, half-way between Rockall and Lousy. This bank, which may prove suitable for line fishing, has been called the George Bligh Bank.

Time and weather did not permit of any trawling on this new bank.

On both voyages very heavy weather was met with. On the second trip, for instance, only five days' fine weather occurred between the 5th and 28th April, the remainder of the time being taken up by a series of gales in quick succession from every quarter. On account of winds and currents great difficulty was found in estimating the position of the ship by dead reckoning, even very approximately, if no sights were obtained for any period over 12 hours.

Altogether the prospects of Lousy Bank becoming a profitable fishing ground are not bright, especially as it is so far from any shelter; and from this point of view the results of the two exploratory voyages were disappointing. The fauna of the Bank proved to be very interesting from a zoological point of view and many rare and beautiful specimens were collected. A report on the first expedition, by Lieut. E. L. Pawsey, R.N. (retd.), Mr. G. T. Atkinson and Mr. F. M. Davis was published in 1920

(Fishery Investigations, Series II, Vol. IV, No. 5). A more complete report relating to both voyages and replacing the first preliminary report, was published in Fishery Investigations (Series II, Vol. VII, No. 2, 1924). A note on the rock fragments obtained appeared in 1923.*

Investigations during 1922-23.

While the years 1919-20 were devoted principally to investigating the effects of the war upon the stock of plaice, and the year 1921 to reorganising the scientific work and opening out new lines of research, the years 1922 and 1923 saw the orderly development of the researches commenced in 1921.

Considerable progress was made in several directions, and much of the work done has been reported upon in the scientific papers appearing in the " Fishery Investigations " series, which are published now in an attractive octavo format, and not as " blue books." It is not here proposed, nor indeed is it possible, to summarise these reports by giving in detail the results arrived at. Only a brief account of the work done and the broad conclusions reached is feasible at this stage.†

Plaice.—No new lines of research were commenced on plaice. The results of the 1920-21 campaign were further considered in their bearing upon the problem of protection, and a summary report was completed and published.‡ A careful watch was kept upon the change in the stock of plaice by study of the commercial statistics and of the records of the fish measurers, the main features of the results of this work being summarised in a report to the International Council.

A collection of nearly 2,000 otoliths was made in May, 1922, along a line from Texel Island to the Leman Bank for comparison with similar collections made in 1906 and 1920, in order to determine what change had occurred in growth rate.

A report on the plaice eggs collected during the spawning season of 1913-14 was prepared and published,§ and the data obtained during the season 1920-21 have been tabulated. The egg production has been calculated by the methods used for the 1913-14 data, and it is thus possible to compare the egg production of these two seasons. For the period 18th December-13th February, the egg production of 1920-21 was very nearly twice as great as in 1913-14. During 1923 work was continued on the same scale, extensive data as to the size of the plaice in different parts of the North Sea being obtained from the work of the fish measurers, and the Leman-Haaks otolith line being worked as usual in May. A considerable transplantation experiment was carried out also in May, with the co-operation of H.M. Fishery Cruiser " Dee " and the Danish Fishery Authorities.* The plaice work during the years 1921-23 is fully reported upon in a paper by Mr. J. O. Borley and Miss Thursby-Pelham,† to which the reader may be referred for the general results achieved.

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* J. N. Carruthers, Geological Magazine, Vol. LX, pp. 462-7, 1923.

† Several papers dealing with the scientific work of the Department were read at the British Association Meeting at Hull in September, 1922 (see *Report of the Ninetieth Meeting of the British Association*, pp. 363, 386 and 371).

‡ *The Plaice Fishery and the War*, by J. O. Borley and collaborators.—Fishery Investigations, Series II, Vol. V, No. 3, 1923.

§ *The Spawning of Plaice in the Southern part of the North Sea in 1913-14*, by H. J. Buchanan - Wollaston.—Fishery Investigations, Series II, Vol. V, No. 2, 1923.

Fauna of the Sea Bottom.—Work with the Petersen grab was continued throughout both years, special attention being devoted to a survey of the Dogger Bank, which was visited in several months of each year. A particularly successful cruise in October, 1922, made it possible to chart out in a reasonably accurate and complete way the distribution of two important bivalve shell-fish which are of great importance as food for plaice and haddock, namely, *Spisula subtruncata*, and *Mactra stultorum*. Both of these were found to occur in enormous numbers, forming dense patches of very considerable extent. The *Mactra* were found principally on the southern half of the Bank in patches of about 15-20 miles in diameter, with a maximum abundance of 6-700 per metre square. The *Spisula* were found in greater abundance in the northern part of the Bank, and in numbers far exceeding those of the *Mactra*. Several extensive patches were surveyed, one of these being as much as 50 miles long by 20 miles broad and containing a population only to be computed in billions. The patches, both of *Spisula* and of *Mactra*, were found to be each populated by one size or age group, some patches containing only the shell-fish of the year, others only the product of the year before, others again, and these quite small patches, only shell-fish of about 2½ years old. Interesting results as to rate of growth and death rate have been worked out from these data, and a first report on the whole investigation was published in 1923.‡ To give some idea of the extraordinary abundance of *Spisula* it may be mentioned that the young forms, a few months old, may run 8,000 to the metre square, the adults up to 1,000 per metre square.

Samples with the grab have been taken also in other parts of the North Sea, to see how they compare in richness with the Dogger Bank. Several rare forms have been taken. A new species of an extremely rare and zoologically interesting primitive form, taken with the grab off the Northumberland coast in August, 1921, has been fully described and figured by Professor A. Meek.§ Further specimens have since been obtained.

Cod Investigations.—The marking experiments on large cod begun in December, 1921, at Flamborough were continued during the early months of 1922 and supplemented by marking on board the research vessel off the Yorkshire coast. Over 700 altogether were thus dealt with, and the returns have been reasonably good. Evidence has been obtained showing that the large cod may carry out extensive migrations both to the north and to the south. Observations were made with a view to determining the average size at first maturity of the cod, and a study was commenced of the stomach-contents. Cod eggs were collected in April on lines from Spurn to the Great Fisher Bank and from Spurn to Tyne. Towards the end of 1922 marking experiments were resumed, 144 fish being marked on a Ramsgate trawler with a new type of mark, which unfortunately proved unsuccessful.

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* For an account of transplantation experiments during 1920-22, see J. N. Carruthers.—Fishery Investigations, Series II, Vol. VI, No. 5, 1924.

† Fishery Investigations, Series II, Vol. VII, No. 7, 1924.

‡ *Quantitative Studies on the Fauna of the Sea Bottom*, No. 1. Preliminary Investigation of the Dogger Bank, by F. M. Davis.—Fishery Investigations, Series II, Vol. VI, No. 2, 1923.

§ *Glossobalanus marginatus, a new species of Enteropneusta from the North Sea.*—Quarterly Journal of Microscopical Science, Vol. 66 (1922), pp. 579-94.

During the summer of 1922 the member of the staff in charge of cod investigations paid a visit to Newfoundland in connection with an investigation undertaken by Dr. Zilva of the Lister Institute into the vitamin content of cod liver oil.* Interesting data on the local " shore " fishery for cod were obtained.

In the spring of 1923 a more intensive study of the eggs and larvæ was carried out concurrently with hydrographical investigations designed to show the subsequent dispersal of the brood, and all the other lines of investigation into the life history of the mature cod taken up in 1922 were further pursued, with the exception of the marking experiments, which were suspended in favour of tank experiments with different types of marks in order to discover a really suitable mark. The results of the two years' work on the large cod of the North Sea have been published in a comprehensive report which gives a reasonably complete account of the life cycle of these fish.†

Valuable assistance in the cod investigations was given by Professor Meek,‡ Director of the Dove Marine Laboratory, Cullercoats, and by Professor Johnstone§ of Liverpool University and his staff working under a scheme of directed research.

Herring Investigations, 1922-23.

I. *Biological Examination of Adult Herrings.*

The biological examination of samples of herring shoals during 1922 was undertaken more for the purpose of a general survey of the product of the fishing from the area of the River Tyne to the English Channel, than for that of an exact investigation into the age-composition of these shoals.

Only 19 samples were taken during the year, and these were from the East Anglian Spring fishing, the Tyne Summer fishing and the East Anglian Autumn fishing.

The samples, each consisting of about 200 fish, were treated in the following manner:—Each fish was measured in centimetres, the condition of the sexual organs was noted (ripe, spawning, spent, &c.), and scales were taken as a means of dividing the fish into the various age groups.

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* See Zilva, Drummond and Graham, *The Relation of the Vitamin A Potency of the Liver Oil to the Sexual Condition and Age of the Cod.*—Biochemical Journal, Vol. XVIII, No. 1, 1924.

† Michael Graham and Collaborators, *The Annual Cycle in the Life of the Mature Cod in the North Sea.*—Fishery Investigations, Series II, Vol. VI, No. 6, 1924.

‡ A Meek, *The Development of the Cod.*—Fishery Investigations, Series II, Vol. VII, No. 1, 1924.

§ J. Johnstone, A Scott and W. C. Smith, *Report on* (i) *The Irish Sea Cod Fishery;* (ii) *The Cod as a Food Fish;* (iii) *Parasites and Diseases of the Cod.*—Fishery Investigations, Series II, Volume VI, No. 7, 1924.

The maturity observations gave valuable information regarding the places and times of spawning and furnished the basis of future intensive work on the subject. All scale readings for this year have, however, been discarded, since it has been shown by further research that the method of their collection was unreliable.

Spawning fish were found off the Northumberland coast near the Hinder Banks and nearer the shore at Kessingland and Hastings, and spent fish were taken in each case, so that definite results as to the time of spawning were obtained.

The length of the samples showed two main groups, 23-24 cms., and 27 cms., but nothing can be said definitely regarding the age of these groups.

Using the survey made in 1922 as a foundation on which to work, a very detailed investigation was begun in the following year.

Starting in March of 1923 and continuing until December, some 60 samples were dealt with, 53 of which were supplied by commercial fishing vessels, the remainder being obtained by the research vessel, " George Bligh," and in addition to the examination of individual fish, a study of the statistics of the herring industry, as a whole, was made. From these data, not only have the age and size of the fish been determined, but also the movements of the herrings have to a certain extent been deduced.

It may be fairly concluded that the bulk of the herrings which were caught between summer and the end of the year were in their fourth or fifth year, and 23 or 24 cms. long respectively.

Another interesting group which appeared from October to December in the southern part of the North Sea was a group with a dominant length of 27 cms. whose scales showed seven rings, *i.e.*, they were probably 8 years old. There were more of these 8 year old fish than there were of 6, 7 or 9 year old fish, and this may be the result of the restricted fishing of 1919. These fish at that time would probably be the predominant group—4 year old—and, as they were not fished so intensely during that year, more of them would survive and live to a greater age.

Much attention was devoted during 1923 to a thorough study of the methods of scale reading and to discussion of the fundamental principles underlying the accepted theory that the age of the fish can be determined by reading the number of rings on the scale. Special meetings of the Herring Committee of the International Council were held for this purpose at Edinburgh in June and at Christiania towards the end of the same month.

Later in the year, a member of the staff spent some weeks in the laboratory of Professor Hjort, studying with Mr. Einar Lea the Norwegian methods of scale reading and the evidence in favour of the Norwegian theory.

II. *Location of Spawning Grounds and Distribution of the Fry.*

In 1922 and 1923 certain cruises of the " George Bligh " were exclusively devoted to the search for the fry of the herring in different parts of the North Sea (South of 56° N.) and English Channel. These cruises took place in the following regions and months :—

1922.	
February ...	Southern Bight, Thames Estuary and Channel, East.
March	Southern Bight, Thames Estuary and Channel, East.
April	Off Frisian Islands in the German Bight across North Sea to mouths of Humber and Wash.
September ...	Off Farne Islands, Whitby, Scarborough, &c.
November ...	Banks off Norfolk, the Wash and across to Holland.
1923.	
January-February	Channel from East to West, Thames Estuary and southernmost North Sea.
November ...	Southern Bight.

Collections of herring fry were also received from the Marine Biological Association and from Belgium (Professor G. Gilson), the *loci* of these collections being off the south coast of Cornwall (January-February, 1923) and off the French and Belgian coasts (February to May, 1923) respectively.

The object of this work, which is still being carried on on similar lines, is twofold :—

(1) To locate spawning grounds or at least spawning regions and to determine broadly where and when the greatest amount of spawning takes place by noting the place and time of occurrence and the relative abundance of recently hatched fry as caught with Petersen's young fish trawl. The material collected in this way was supplemented by records as to the approximate place and date of capture (together with the weight of catch in most cases) of certain landings of " spawny " haddock (*i.e.*, of haddock full of herring spawn). These records, of which some 30 or so were received in 1922-23, were obtained through the agency of Collectors of Fishery Statistics at North Shields, Grimsby, &c.

(2) To follow the movements of the fry away from the spawning grounds and to estimate their average rate of growth during the course of their early life history. This task has involved the careful study of water movements in the regions sampled for fry at and between the dates of various young herring cruises. The necessary data as to drift were obtained either directly by liberating drift bottles at the time at places at which particularly large numbers of recently-hatched fry were caught; or indirectly by the analysis of concurrent Meteorological Office wind records and their application to the results of the extensive drift-bottle experiments which were carried out by the Ministry during the period September, 1920—September, 1921.

The work so far done on these lines, supplemented by data from other sources, *e.g.*, the actual capture of spawn on one occasion and of notable quantities of actually spawning fish on several others, is considered to provide substantial evidence in favour of the following conclusions:—

(a) There are definite spawning places close to the Farne Islands and off Whitby and Scarborough. On these grounds spawning takes place from July to September.

(b) Spawning on a large scale takes place principally in the early part of November on the rough grounds east of the Humber and Wash and somewhere in the region of the Cromer Knoll and Haisborough Sands.

(c) A considerable amount of spawning takes place somewhere in the region of the Outer Gabbard, Hinder and Sandettie Banks from early November to December and even later.

(d) There are numerous winter spawning grounds in the Channel (one especially productive lying about a line between C. Antifer and Beachy Head) and a total productivity of spawn and fry which is probably at least comparable with that of the chief spawning areas in the North Sea. In the Channel generally the height of the spawning period appears to be in early January.

As to the subsequent fate of the fry after hatching, there is evidence that in the Southern Bight, Thames Estuary and Ostend Harbour there occurred in the early parts of 1922-1923 a mingling of autumn-spawned fry of North Sea origin, with winter-spawned fry of Channel origin and, further, that the latter were (in 1922) transported into the German Bight by the north-eastward flowing continuation of the normal up-Channel current.*

Hydrography.—The investigation of hydrographical conditions during 1922-3 has been carried out by several agencies, the Ministry's research vessel, commercial vessels and light vessels being utilised in the collection of material and records, while the analysis of the water samples collected has been carried out by the staff of the Government Chemist.

Water samples and temperature records were collected by steamships along several routes in the Channel and the Atlantic, and a better system of sampling was instituted in the North Sea. Determination of the salinity of the numerous samples obtained entails a great volume of work, and with the aid of the Government Chemist and the National Physical Laboratory the possibilities of arriving at quicker methods were explored but without any great success.

The investigations have been designed both to ascertain the general physical and chemical features and the main movement of the water masses in the North Sea and Channel during the year, and to investigate the relations subsisting between these and the herring shoals. With the latter object plankton samples have in all cases been taken by the "George Bligh" at her hydrographic stations. In May and October every year lines of observations are run from the north-east coast of England to Norway, a line permitting the influx of Atlantic water from the north to be examined. Numerous cruises were made during which young and post-larval herrings, plankton and the sea water were examined jointly.

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* See *First Report on Young Herring in the Southern North Sea and English Channel, Part I*, by W. Wallace and J. H. Carruthers.—Fishery Investigations, Series II, Vol. VII, No. 4, 1924.

In the spring of 1922 a special investigation was carried out during the Cornish mackerel fishing to ascertain whether, as had been suggested by a skipper, there is any connection between the temperature of the water and the catch of mackerel. The results, which so far as they go are definitely negative, were published in the *Journal of the Marine Biological Association.**

Plankton.—The work has been devoted mainly to a study of the food of the herring at all stages, and of the plankton found in the vicinity of herring shoals. Attention has also been devoted to the variations in the plankton due to vertical movements and to shoaling. As exemplifying the kind of problems investigated the following may be mentioned :—

(a) During March, 1922, the research vessel remained at one station for 24 hours, and hauls were made every six hours, under similar conditions as to tide, &c. Interesting variations in quantity and composition of the catches were found. These observations were repeated during 1923.

(b) A survey of the plankton of the herring fishing grounds (25 miles E.N.E. from Tyne) was made in the early part of July, 1922, when the drifters were making very poor catches. The copepod plankton (the principal food of the herring) was very rich in the waters below 10 fathoms, but there was surprisingly little at the surface; there was a distinct movement of the plankton towards the surface during the night, but it was of short duration, because the hours of darkness were so few. When a line of stations was worked in an easterly direction away from the herring grounds, it was found that the plankton greatly decreased in quantity, the rich red colour which characterised the plankton of the fishing ground rapidly changing to almost white. A report is in preparation.

(c) During a cruise in October, 1921, dense masses of the needle-shaped diatom, *Rhizosolenia styliformis*, were found at about lat. 54° N., long. 3° E., and near the Smith's Knoll Light Vessel. A similar patch was found during November, 1922, about forty to fifty miles further east; this patch was surveyed and it was found to be about 3-4 miles wide; its southerly limit was in the region of the Brown Ridges, and from thence it extended in a north-easterly direction for about 50 miles. The northerly limit was not determined as bad weather intervened. The diatom causes the water to have a dirty brown colour, and is well known by fishermen as "tobacco juice." It is believed to exert a considerable influence on the shoaling of plankton-feeding fish by forming a kind of barrier which repels them. This work was repeated in November, 1923, and will shortly be reported on.

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* J. R. Lumby.—*The Relation between Catches of Mackerel and the Surface Temperature in situ.*—Journ. M.B.A. (N.S.) Vol. XIII, pp. 236-42, 1923.

(d) Extensive trials have been carried out with an instrument devised by a member of the staff, consisting of a hollow cylinder tapered at both ends (inside which is fixed a disc of silk netting) which can be towed behind a drifter going at full speed. The plankton collects on the disc and gives it a distinctive colour. A number of drifters have been co-operating in these experiments, and it is hoped that by comparing the catches of herring (or mackerel) with the appearance of the discs a colour chart can be made which will indicate to the fishermen whether they are in favourable or unfavourable waters for catching fish.

During the two years, about 14,000 stomachs of larval, post-larval, whitebait and mature herrings were examined and their contents recorded. By arrangement with skippers, stomachs of freshly caught mature herring were preserved on board drifters at sea for examination at the laboratory. A report on this work has been published.*

Aerial Spotting of Fish.—In October and November, 1921, and again in March, 1923, several seaplane flights were carried out by the courtesy of the Air Ministry with a view to testing the possibilities of spotting shoals of herring and mackerel from the air. The results obtained† were not promising, and the matter has not been further pursued. (See also p. 137.)

Oyster Investigations.—A report was issued upon the results of an extensive series of chemical analyses of oysters carried out by the Government Laboratory, in which it is shown that the fattening of the oyster in the autumn is due to the storing of glycogen in the tissues.‡

In 1923 was commenced an investigation into the food of the oyster and into the plankton over the beds in the Orford River.

The enquiry by Dr. Orton, Professor Eyre and Dr. Brady into the cause of the abnormal mortality of oysters in 1920-21 is referred to elsewhere in this Report (p. 94). It only remains to mention that the full results have been published in Fishery Investigations, Series II, Vol. VI., Nos. 3 and 4, 1924.

Publications.—Reference has been made above to many of the scientific papers issued by the Department. To complete the list issued up to date mention may be made of the following :—

The Marine Deposits of the Southern North Sea, by J. O. Borley. Fishery Investigations, Series II, Vol. IV, No. 6, 1923.

An Account of the Fishing Gear of England and Wales, by F. M. Davis. Fishery Investigations, Series II, Vol. V, No. 4, 1923.

Report on Experimental Hauls with Small Trawls in certain Inshore Waters off the East Coast of England, by W. Wallace. Fishery Investigations, Series II, Vol. V, No. 5, 1923.

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* A. C. Hardy.—*The Herring in Relation to its Animate Environment. Part I.—Report on the Food and Feeding Habits of the Herring, with Special Reference to the East Coast of England.*—Fishery Investigations, Series II, Vol. VII, No. 3, 1924.

† A. C. Hardy.—*Report on the Possibilities of Aerial Spotting of Fish.*—Fishery Investigations, Series II, Vol. VII, No. 5, 1924.

‡ E. S. Russell.—*Report on Seasonal Variation in the Chemical Composition of Oysters.*—Fishery Investigations, Series II, Vol. VI, No. 1, 1923.

Grants to Local Institutions.

The years 1919 and 1920 were years of transition for the majority of local institutions aided by grants from the Development Fund, as, during this period, more comprehensive plans for the co-operation of local scientific bodies in a general scheme of fishery research were being prepared and considered. In order, however, to secure continuity of work, interim grants from the Development Fund were recommended for the financial years 1919-20 and 1920-21 on a somewhat more substantial basis than in previous years. The total amount from all sources available in each year was £4,000 :—

	Amount of Grant in each of the years 1919-20 and 1920-21.	Corresponding Grants in 1913-14.
	£	£
(a) Armstrong College (Dove Marine Laboratory)	600*	200
(b) Marine Biological Association ...	1,000†	500
(c) University College of Wales (Department of Zoology)	250	50
(d) Liverpool University—		
Port Erin Biological Station ...	—	100
Department of Oceanography ...	500‡	—
(e) Lancashire and Western Local Fisheries Committee	1,650	1,640
(f) Eastern Local Fisheries Committee	—	50

These advances were provided for the continuance of existing researches and for the early stages of the extended programmes of investigation. These programmes were drawn up by the institutions and submitted in a general form without details.

During 1920 the various authorities concerned were informed that the time had arrived when such interim grants should be replaced by more permanent and comprehensive provisions, and that for the future, in approved cases, maximum grants would be laid down over a five year period, subject to funds being available and the general standard and character of the work being considered satisfactory. As a matter of fact, only the Plymouth Laboratory and the Dove Marine Laboratory did receive promises of a five-year grant. Instructions were subsequently issued that in future the following procedure would be followed in applying for grants from the Development Fund :—

(1) The Ministry would apply to the Treasury for grants from the Development Fund in aid of fishery researches directed to the

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* In 1920-21 a further interim grant of £850 was paid in accordance with the new scheme which is described later.

In 1920-21 the following capital grants were made :—

(*a*) £200 for reconditioning of motor boat;

(*b*) £200 for repairs and additions to laboratory and equipment.

† In 1920-21 special grants under the new scheme were made in addition as follows :—

(*a*) £5,000 for maintenance (only £2,000 was actually paid);

(*b*) £6,835 capital grant to provide new laboratories and a steam drifter and gear, provided a sum of £4,235 was received from private sources.

The Association also received £1,000 direct from the Treasury in each of these years.

‡ In 1920-21 a further interim grant of £300 was paid out of savings on other Development Fund services.

In connection with the English plaice work for the International Council for the Exploration of the Sea, a special grant of £1,500 for investigations in the Irish Sea was made to the University of Liverpool in 1920-1921.

solution of definite economic problems affecting the fishing industry. Institutions might, with the approval of the Ministry, undertake a share in the "directed" researches, in which case the Ministry would apply for funds on their behalf and exercise a general supervision over the work. All grants for "directed" research would be borne on the Ministry's Vote.

(2) Applications for grants in aid of "free" research into the fundamental problems upon which the development of marine science depends would be made direct to the Treasury by the institutions and would be referred to the Ministry for report purposes only. These grants might take the form either of a grant in aid of the general maintenance of a laboratory or of a grant for a specific piece of fundamental research.

The Development Commissioners further laid it down that grants to institutions in respect of capital expenditure would normally only be made if an equivalent amount were raised from private sources. With regard to maintenance grants also, stress was laid on the importance of increasing considerably the independent income of the various institutions. At the same time, in order to secure proper co-ordination, all applications for grants, whether in aid of "directed" or of "free" researches, would be examined and considered by the newly appointed Advisory Committee on Fishery Research of the Development Commission. By this means overlapping would be prevented and a connected and comprehensive scheme of fishery research, whether carried out by the Ministry or by local institutions, would be evolved. The results of this step have been of the greatest practical value.

The accounts of all institutions receiving grants are examined by the Ministry and reports upon the work done are submitted in the case of "directed" researches to the Ministry, and, in the case of "free" researches, to the Advisory Committee of the Development Commissioners.

The following grants to local institutions in aid of both "directed" and "free" researches were sanctioned in respect of the financial years 1921-22, 1922-23, and 1923-24.

	1921-22.		1922-23.		1923-24.	
	Directed Researches	Free Researches	Directed Researches	Free Researches	Directed Researches	Free Researches
	£	£	£	£	£	£
(1) Armstrong College—Dove Marine Laboratory	—	1,835*	200	1,500	100	1,500
(2) Marine Biological Association—Plymouth	—	9,100	—	10,400‡	—	9,814
(3) University College of Wales—Department of Zoology	—	300†	—	300†	150	300†
(4) Liverpool University—Department of Oceanography	1,500	400	1,200§	—	575	—
Port Erin Biological Station	—	1,000	—	790	—	800

* Maintenance £1,500. Capital—Additional £212 for reconditioning motor boat; additional £123 for reconditioning laboratory.

† Specific investigation into the beach fauna of Cardigan Bay.

‡ £9,000 paid. § £1,000 paid.

Detailed accounts of the work carried out by local institutions in connection with these grants during the years under review will be found in the Annual Reports of the various institutions and of the Development Commission. A brief note, however, of the work carried out at the institutions by means of their "directed" research grants is appended.

Armstrong College.

In 1922-23 a grant of £200 was sanctioned in aid of the cod and herring investigations to be carried out at the Dove Marine Laboratory as part of the programme of the International Council for the Exploration of the Sea and of an investigation into the pollution of the River Tyne, in conjunction with the River Tyne Sub-Committee of the Ministry's Standing Committee on Rivers Pollution.

In 1923-24 a grant of £100 was sanctioned for the continuation of the investigation into the pollution of the River Tyne.

Liverpool University.

In 1921-22 the Department of Oceanography undertook, on behalf of the Ministry, certain researches in the Irish Sea complementary to the general programme of plaice investigations conducted by the Ministry under the scheme of the International Council.

Investigations on the life history of the plaice in the Irish Sea were carried out. Other work included herring, cod and hake investigations, and preliminary arrangements were made for a programme of hydrographical work in the Irish Sea in co-operation with the Ministry.

In 1922-23 and 1923-24 further investigations in the Irish Sea, complementary to those carried out by the Ministry elsewhere, were undertaken. The researches included an investigation of the plaice fisheries of the Irish Sea and Solway Firth, and of the small plaice inhabiting the Mersey Estuary; investigations into the cod and herring fisheries of the Irish Sea and hydrographical and plankton investigations. A list of reports published under the scheme of directed research is given on p. 154 of this Report.

EXPENDITURE ON SCIENTIFIC WORK DURING FIVE YEARS ENDED 31ST MARCH, 1924.

Subhead.	1919/20.	1920/21.	1921/22.	1922/23.	1923/24.
	£	£	£	£	£
Fisheries Research (Grants in aid to Local Institutions)	3,734	4,067	1,657	1,200	757
Fisheries Research (General) conducted by the Department—					
Ichthyometric Investigations	2,188	3.571	2,558	2,839	2,718
Miscellaneous Researches Purchase and Maintenance of Research Vessel ...	715	36,812*	13,273	8,343	8,185
Purchase and Maintenance of Lowestoft Laboratory ...	—	7,399†	792	317	248
Shell-fish Research—					
Oyster breeding and cleansing experiments	106	695	1,976	707	444
Maintenance of Conway Laboratory	—	—	149	94	99
Purchase of Conway Laboratory	—	—	—	—	1,000
Salaries of Scientific Staff	6,853	8,546	11,722	11,065	11,783
Travelling Expenses do.	1,110	1,209	1,416	1,385	1,534
Total	£14,706	£62,299	£33,543	£25,950	£26,768

* Includes purchase and equipment of Research Vessel "George Bligh."

† ,, ,, ,, Laboratory at Lowestoft.

CHAPTER VII.—SHELL-FISH.

MORTALITY AMONGST OYSTERS.

In the summer of 1920 reports were received from oyster merchants of an unusually heavy mortality among oysters on certain of the Thames Estuary beds. The mortality persisted during month after month, and on some grounds was calculated to be as high as 50 per cent. of the total number of oysters on the grounds, brood as well as marketable oysters being affected. The total loss to the oyster planters concerned was estimated at a sum of about £250,000 by the end of the autumn.

In view of the serious threat to the industry, application was made to the Ministry, as the Department concerned, to take immediate steps to investigate the question, and a grant of £1,000 from the Development Fund was sanctioned by the Treasury to the Oyster Merchants and Planters' Association for the purpose, on condition that the Association contributed £500 towards the expenses and that the general supervision of the work was undertaken by the Ministry. The scheme of investigations was agreed upon after thorough discussion between the Association, the Development Commission and the Ministry; and Dr. J. H. Orton of the Marine Biological Association, Plymouth, was appointed biologist in charge, with Prof. J. W. Eyre and Dr. O. L. Brady to assist him as expert in the bacteriology of the oyster and chemical expert respectively. Assistance was also rendered by the Government Chemist, Mr. D. J. Matthews of the Hydrographical Department, Admiralty, and members of the Ministry's Scientific Staff.

During the year 1919 and the early part of 1920 considerable quantities of surplus and waste ammunition were disposed of by dumping them into the sea on various sites, and one of the sites selected for the dumping of considerable quantities of waste explosive of a kind known as "T.N.T." was the Black Deep in the Thames Estuary, which for some years has been used as a dumping ground for sludge. It was not, therefore, unnatural that the oyster planters of Kent and Essex should connect the mortality among oysters with these operations. Moreover, in addition to the dumping of waste ammunition in the Black Deep by the Disposals Board there was reason to suspect indiscriminate dumping by private firms, and there was also the possibility of damage resulting from the cargoes of vessels sunk during the war in the Estuary.

The course mapped out for the investigations by Dr. Orton was therefore largely determined by a consideration of these possible causes of the mortality, and an exhaustive study of the effects of the substance T.N.T. in its relation to sea water and marine life was made under his direction. A full report on the investigations has been prepared by Dr. Orton.* The report warrants the conclusion that the unusual mortality was not due to T.N.T. in solution nor to the ingestion by oysters of grains of T.N.T., but that it was possible that a small and negligible amount of death may have occurred by the latter means. The following account gives in briefest outline some of the steps taken and conclusions arrived at by Dr. Orton in connection with the investigations.

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* *An Account of Investigations into the Cause or Causes of the Unusual Mortality among Oysters in English Oyster Beds during 1920 and 1921*, by J. H. Orton, D.Sc.—Fishery Investigations, Series II, Vol, VI, No. 3 (Part I.—Report), No, 4 (Part II.—Appendices), 1924.

When the investigations were begun at the end of October, 1920, the mortality of oysters was found to be very low. At Mersea the mortality was said to be over, and very few weak oysters could be obtained. At Whitstable at this time weak oysters could be obtained in the proportion of about 1 in 400, but the number decreased at once to a minimum of about 1 in 1,000 in April, 1921, but increased afterwards, according to the records of the oyster merchants to about 1 in 100 in July, 1921, and afterwards decreased to 1 in 1,000 or even 1 in 3,000 in the winter of 1922-23.

Normal annual mortality among oysters is estimated at 10 per cent. on locally grown oysters and 15 per cent. on English relaid oysters. The bulk of the normal mortality occurs in summer during the spawning period.

In October and November, 1920, a biological survey was made of the oyster beds, and the condition of the water itself was found at that time to be normal so far as could be ascertained. Dredging and tow-netting operations were carried out in the Black Deep, the centre of the supposed poisoning, but numerous bivalves allied to the oyster were found of an age estimated at certainly not less than six months, and a few weeks later lobsters and other animals were trawled up from the same area. Large numbers of samples of water were analysed for T.N.T., but without success. It was also found that less death occurred among oysters confined in a cage containing 3 to 3½ lbs. of T.N.T. moored on oyster beds in the sea than among others confined in a cage without T.N.T.; that animals grew on the wooden cage containing T.N.T. in the sea; and that oysters kept in a series of four small tanks fed by fresh sea water drawn through a tank containing 10 lbs. of T.N.T. experienced no appreciable mortality in the last tank of the series after five winter months. Other experiments have shown that T.N.T. is only very slightly soluble in sea water, and that in solution it is destroyed by light as well as by micro-organisms and other organisms.

The possibilities of poisoning by sodium picrate, nitrates, oil, copper, zinc, mercury, barium and aluminium were also considered and eliminated as causes of unusual mortality.

Arsenic was found in oysters and soils on oyster beds, but there is not sufficient evidence to connect these discoveries of arsenic with the mortality among oysters.

Reports of unusual mortality in 1920 were received from oyster planters in Italy, Holland, some parts of France, the Isle of Wight and Swansea, and in 1921 similar reports were received from various parts of the coast of England, Ireland, France and Holland, but not from Scotland or Italy. No unusual mortality occurred in America in either year among American oysters.

There was no uniformity in the conditions in the localities where oyster mortality was reported—some beds are in regions of heavy shipping traffic, but others are remote from such—nor was there any uniformity in the date at which the mortality was reported.

The abnormal weather of the summer of 1920 has been parallelled only once within the last 50 years, namely, in 1912. In that year greater fluctuations of temperature and—so far as can be ascertained—of salinity occurred than in 1920. If, therefore, no unusual mortality occurred in 1912 none was to be anticipated merely from the same causes in 1920. No reliable data for 1912 can be obtained from any number of oyster beds, but the oyster planters themselves mostly report no recollection of abnormal mortality in that year. At the same time, it is not safe absolutely to rule out the influence of the abnormal weather of 1920, since it is now known that whenever spawning oysters are subjected to relatively cold water of low salinity for an appreciable period there would be an accentuation of the normal spawning mortality. The extent of that accentuation is undeterminable, but it is considered extremely unlikely that weather conditions could account for the 35-40 per cent. mortality (50 per cent. less an estimated normal mortality of 10-15 per cent.) in 1920.

Careful but admittedly inadequate microscopical and bacteriological investigations were carried out and fresh preparations of oysters were examined unsuccessfully for parasites, and infection experiments failed to indicate the presence in oysters of any parasite of an infectious character.

In short, while it was possible practically to prove that the dumping of certain known munitions was not responsible for the abnormal mortality, so little is known of the pathology, physiology and even histology of the oyster that it was not possible to discover what was the cause. Research is, however, being continued along lines suggested by discoveries made in the course of the earlier investigations.

MUSSEL CLEANSING.

The system of mussel cleansing described in the last Report* (pp. 91-99) has been successfully continued each season. An improvement has been introduced in connection with the system of flushing to remove the mud, mussel dejecta, &c., which collect on the floors of the tanks beneath the wooden grids after the hosing of the mussels. Formerly the grids were mounted on wooden feet, the refuse being flushed out by hosing with high pressure fresh water. This method had three drawbacks. Firstly, the hosing was liable to throw some of the dirt and grit back against the underside of the grids, which was objectionable from a bacteriological point of view. Secondly, the process was an extremely irksome and lengthy one, occupying several hours per tank; and, thirdly, floor space had to be sacrificed for the making of walks to allow of hosing under small sections at a time. The slope of the tank floors has now been remodelled, so as to give an even gradient. Parallel concrete ridges 4 in. high traverse the floors from back to front, forming a series of twelve separate channels. The ridges act as supports for the four foot grids, the objectionable feet being dispensed with. On the upper end of the tank floor a concrete wall has been erected, forming a transverse channel 9 in. wide and 1 ft. 9 in. deep. This wall is pierced opposite the upper end of each channel under the grids by an opening 9 in. by 4 in., each orifice being closed by a wooden penstock door. In order to cleanse the under-grid channels, after the mussels have been hosed, the transverse channel is filled with sterilised water from the chlorinating tank, and kept full during operations by adjustment of inlet valves. The penstock doors are then opened one after the other for a few seconds, the rush of water thus liberated thoroughly scouring the channels under the grids; the debris being carried into a transverse channel at the lower end of the tank, and thence down the drain. Before the penstocks are opened, the water is allowed to overflow the channel wall for a short time to wash out the upper corners of the channels, the top of the wall being specially "castellated" to secure the best results. This procedure eliminates all the objections to the old system enumerated above. There is no splashing of debris back on to the grids; the operations take little more than as many minutes as they formerly took hours, and are more thorough. The mussel capacity of the tanks is also increased 26 per cent. This improvement was completed in June, 1921, and was in operation at the opening of the following mussel season. In justice to the Ministry's Technical Staff it must be said that this improvement would have been made at least a year earlier if their arguments in favour of it had prevailed.

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* *Fisheries in the Great War,* being the Report on Sea Fisheries for the Years 1915 to 1918. (For particulars see cover.)

Increased Output.

With the pumping plant originally installed, the output was limited to three single tanks per week, that is to say, 260 bags of mussels per week. With demobilisation, the demand for space became greater, and the output of each man had to be considerably limited. As a consequence, the fishermen were naturally and quite reasonably anxious that the potential output of the tanks should be increased. Such increased output could only be achieved as a result of a considerable expenditure of capital on the installation of a more powerful pump, and the doubling of the capacity of the suction and delivery mains. In view of the ruling high cost of material and labour, and the need for economy, the question was one requiring very careful consideration.

The system in use being such that, as far as the consumption of water is concerned, a cleansing tank cannot be fractionally used, except within very narrow limits, it necessarily followed that the smallest possible increase of capacity was 100 per cent., which, owing to the limitations of time, was also the maximum. The question arose whether the fishery as at present conducted would be capable of carrying an output of the order of magnitude indicated, without suffering serious depletion, and the conclusion was arrived at that it was more than probable that it would not. This conclusion was based on the results of a series of surveys of the fishery, extending over some four years, and general deductions from data as to the rate of growth of mussels in the Estuary and other relevant factors. It was strongly confirmed by the history of the fishery, which was practically fished out by 1912, as a result of an annual out-take of not more than about two-thirds of the maximum that could be dealt with under the contemplated scheme of double working. The figures of output prior to 1912 were derived from the Railway Company's returns and were therefore reliable. The history of the spat falls during these years showed that there had been no abnormal dearth. The fishery had time to recuperate during the three or four years after its closure under the Conway Mussel Order of 1912, and had been able to carry an output of some 260 bags per week for four years without demonstrable injury, except in the case of certain sheltered areas which, although the fishermen were strongly urged to keep them as reserves for supplies during bad weather, were indiscriminately fished and eventually stripped.

From the beginning of the Ministry's activities at Conway the fishermen were constantly urged to relay mussels with a view, not only to ensuring and increasing the future supply, but also of improving the average quality by transferring poor mussels from the high banks to suitable fattening grounds.

The Ministry's advice was consistently ignored, but, when the demand for increased tank accommodation, with the prospect of double output, was advanced, the Ministry felt obliged to make it a condition of this development that an adequate scheme of transplantation should be framed and carried out. In September, 1919, the Conway River Fishermen's Co-operative Society was framed under the guidance of the Fisheries Organisation Society. Practically all the mussel fishermen became members of it, and negotiations between the fishermen and the Ministry were conducted through it. The men promised to relay, but failed to keep their promise, and the Ministry accordingly declined to proceed with the work necessary for securing double output. Subsequently, in the spring of 1921, a further promise was given on behalf of the fishermen, and a half-hearted and unsatisfactory beginning of relaying was made, on the strength of which the Ministry proceeded with the work. Having thus secured the completion of the work and the double output, the fishermen, in the following year, deliberately, definitely and finally ceased all relaying operations. They argued that relaying was unnecessary on account of a particularly abundant spatfall which had taken place. It was pointed out to them that abundant spatfalls were of little use unless something was done to conserve them, and the Ministry threatened to close one tank and to raise the fee for the other unless adequate relaying was carried out. Eventually, however, on the signing of an undertaking by all the men to relay if and when they were called upon to do so by the Ministry (a demand which has not been made, largely because the subsequent out-take for one reason and another was small) the Ministry agreed to keep both tanks open. The attitude of the fishermen towards every suggestion for the improvement of their fishery, their failure to abide by any undertaking given by them, and their general attitude of hostility to the Department has greatly hampered the Ministry's endeavours to assist them.

Conway River Fishermen's Society.

The history of this society has been tragic. Mutual distrust among its members and deliberate endeavours on the part of some of them to wreck it have made it a source of weakness rather than of strength. Arrangements for co-operative marketing of the mussels were speedily wrecked by malcontents, and the internecine strife within the society was such that both the production and marketing of mussels was hampered rather than facilitated. Endeavours were made through the society to induce the men to grade their mussels—an easy task, as there is natural grading on the various banks and channels. They persisted, however, in mixing all grades, and were content to receive for all grades together a price which was fixed by reference to the lowest. In all the circumstances, there is no cause for surprise in the fact that the Conway Fishermen's Co-operative Society is for all practical purposes defunct.

The Market for Cleansed Mussels.

In the last Report the results of working at the Conway tanks during the season 1918-19 (September-April) are referred to. During that period 7,606 bags of mussels (approximately 500 tons) were cleansed, the average price obtained by the fishermen being about 15s. per bag.

High prices continued during the seasons 1919-20 and 1920-21, from 15s. to 18s. per bag being the rule, except for a few weeks at the end of the seasons, at which time there is always a falling off both in quality and demand. In 1919-20, 6,707 bags were dealt with and in 1920-21, 6,980. With regard to the latter season it is interesting to note that the demand was consistently greatly in excess of the supply. There is no reason to doubt that the high prices would have been maintained even with the double output which might have been secured if the fishermen had fulfilled the necessary conditions (see p. 98). It is a somewhat tragic circumstance that 1920-21 was the last year of boom prices.

The season 1921-22 was the first during which the increased output capacity (18,000 bags in a season of average length) was available. During the season, 10,706 bags of mussels were cleansed. This was a disappointing result, to which various causes contributed. In January and February, the number of days too stormy to admit of fishing was unusually large. The season started late (24th September), at the special request of the Secretary of the Fishermen's Society, who wished to postpone operations until the co-operative trading scheme was organised. Probably the chief cause of shortage lay in the quarrels between the men, referred to above.

Prices fell seriously during the season. It is difficult to obtain authentic information about prices as the men are reticent on the subject. It is possible, however, by reference to the audited accounts of the Society, to show that the average net price, resulting from co-operative selling after deduction of all charges, was 6s. 6d. per bag for the season. It is interesting to note that before the war prices were often as low as 1s. 6d. per bag, 4s. being considered a very good price, only obtainable for the best mussels.

During the season 1922-23, only 8,955 bags of mussels were brought to the tanks for cleansing. The demand was small and prices low. Some of the men are known to have been able to secure a price of 10s. per bag throughout the season; others appear to have received less. After deducting charges, that is to say railway carriage (which has continued to be extremely heavy), cleansing fee, market commission, &c., the net receipts have probably ranged on an average from 2s. 6d. to 4s. 6d. per bag. This is a serious drop, and naturally caused much dissatisfaction. It must be remembered, however, that such prices are considered satisfactory, not only by men at other home fisheries, but in Holland (where the cost of living is very much the same as here). Others, moreover, and especially the Dutch, transplant and cultivate mussels industriously; the Conway men are mere gatherers of Nature's harvest.

The prospects for the future depend in the main upon the purchasing power of the community, the quality of the mussels and, as regards Conway, the abandonment by the men of their mediæval methods. The first depends upon factors outside the scope of this Report. As to the second, a bad year at Conway is very rare, and improvement of the quality, which was distinctly below the average in the season 1922-23, may be looked for. The outlook as regards the third is not hopeful.

It is interesting to compare the retail price of mussels with that realised by the producer. The Ministry has been informed on reliable authority that in February, 1923, Conway mussels were on sale in the fish market of a large town, which took a regular supply of them, at 3d. per lb. A bag of fresh mussels weighs about 148 lbs., and the loss of water after keeping the mussels for a few days might reduce the weight to about 115 lbs. Taking 125 lbs. as a reasonable average weight, the mussels at their retail price were worth 31s. 3d. a bag. The Ministry has evidence from the invoice that the mussels in question were purchased at 9s. per bag, and that the fishermen, after paying charges amounting to 5s. 3d., received 3s. 9d. only.

MUSSEL CLEANSING AT CONWAY.

Statement of Receipts and Expenditure.

(Trading and Profit and Loss Account.)

1918-1919.

	£	£		£
To Running Expenses :—			By Cleansing Fees	388
Salaries and Wages ...	163		,, Net Loss	71
Chemicals, Fuel, Oil, Repairs and Miscellaneous	115			
		278		
,, Rates, Interest Depreciation. Headquarters' Establishment Charges and Insurance		181		
		459		459

1919-1920.

To Running Expenses :—			By Cleansing Fees	340
Salaries and Wages ...	180		,, Net Loss	196
Chemicals, &c.	168			
		348		
,, Rates, Interest, &c. ...		188		
		536		536

1920-1921.

To Running Expenses :—			By Cleansing Fees	526
Salaries and Wages ...	201		,, Net Loss	80
Chemicals, &c.	111			
		312		
,, Rates, Interest, &c. ...		294		
		606		606

1921-1922.

To Running Expenses :—			By Cleansing Fees	808
Salaries and Wages ...	215			
Chemicals, &c.	141			
		356		
,, Rates, Interest, &c. ...		292		
,, Net Profit		160		
		808		808

1922-1923.

To Running Expenses :—			By Cleansing Fees	672
Salaries and Wages ...	248			
Chemicals, &c.	99			
		347		
,, Rates, Interest, &c. ...		284		
,, Net Profit		41		
		672		672

Net loss over five years' working (including interest adjustment for previous years)–£152.

Notes :—(1) Interest calculated on Fixed Capital at Local Loans minimum rates in force when respective payments were made, and on Working Capital at average during year of account rounded up to the nearest one-eighth per cent. above Bank Rate, less one-third charged to Oyster Experiments.

(2) Depreciation calculated at 1 per cent. per annum on Tanks, 3 per cent. on Engine House, Mains, &c., 7½ per cent. on Gas Engine and Pump, and 10 per cent. on other assets, less one-third charged to Oyster Experiments.

(3) Headquarters' Establishment Charges, originally calculated at 7½ per cent. on gross receipts, consist in the second and later years of a proportion of the salaries of Scientific and Administrative Staff concerned with the conduct of the scheme.

(4) Insurance covers Workmen's Compensation and risk of loss of Buildings, Furniture &c. by fire.

Financial Considerations.

The cleansing process has been worked on a self-supporting basis, and, in making up the trading account, full allowance has been made for all contingent charges such as the cost of staff and material at headquarters, interest on capital, depreciation, insurance, &c.

The original fee for cleansing was 1s. per bag, but it was found necessary to increase the fee to 1s. 6d. per bag in the season of 1920-21, on account of the general increase of costs after the war. It was hoped that, when the capacity of the tanks was increased, it would be possible to reduce the fee to 1s. or less, but, as has been explained above, the output was disappointing and a reduction of fee was not practicable.

Mussel Cleansing in the Exe Estuary.

The mussel fishery of the Exe Estuary is subject to serious pollution, and, attempts to mitigate the danger from pollution by local relaying having failed, the fishery was closed by the Ministry of Health in view of the danger to public health involved in the consumption of mussels from this polluted area.

The fishery was exhaustively investigated by the Fisheries Department with a view to the installation of cleansing tanks. The case was beset with difficulties, notably that of getting water of sufficiently high salinity in the neighbourhood of available tank sites. A prolonged series of specific gravity observations was made, extending over some months, and in this connection the Ministry is much indebted to Mr. Tickle, Public Analyst of Exeter, and to Mr. Moulding, Borough Surveyor of Exeter, for valuable help.

After weighing the merits and demerits of the various sites, which are too complicated to deal with in a short report, it was decided to recommend one near Starcross Station on the west side of the Estuary. Here the difficulties with regard to salinity were negligible, transit facilities by the Great Western Railway were ideal, and other conditions favourable. The capital cost of the undertaking would also have been small, as the necessity for long and costly pumping mains would have been avoided. Another advantage of having tanks on this side of the river was that the men would have been encouraged to transfer their layings by degrees from the east to the west side of the estuary where the conditions for fattening are better.

Erroneous information given to the Ministry led it to understand that the suggestion of a site on the Starcross side was impossible, and eventually a site was secured on the east side of the river at Sowden End, near Lympstone. The construction of the tanks was, however, subject to various delays. In the first place there was postponement because, owing to the inflation of prices in the building and engineering trades at the time when the scheme was first put forward, it was impossible to get an estimate for construction which would not overweight the scheme with capital charges.

The period of construction was also prolonged. Work was begun at the end of 1921, and it was confidently hoped that it would be in working order by the beginning of the mussel season in September, 1922, but difficulties arising from peculiarities of the soil and bad weather conditions created delays.

The installation was handed over by the engineer in charge in January, 1923, but various adjustments and alterations were soon found to be necessary.

The principle of the system of cleansing adopted is the same as that at Conway, but topographical and other local conditions have rendered it necessary to modify the means employed of achieving the desired ends.

It has been impossible to dispense with the large storage tank, owing to the difficulties experienced in obtaining water of proper salinity at this particular site. This tank is tidal, and can be filled in from twenty minutes to half-an-hour on the top of the tide. The water is pumped up from this tank to the chlorinating tank, and thence to the cleansing tanks. At Conway, on the contrary, the storage tank is at the highest level, the chlorinating and cleansing tanks being filled by gravity. At Conway a supply of high pressure fresh water is available for hosing the mussels, but at Lympstone, the hosing water has to be pumped under pressure, sterilised sea water from the chlorinating tank being used.

Certain structural modifications have been introduced by the engineer in charge. For instance, the large storage and chlorinating tanks are circular, instead of rectangular, as at Conway. His purpose is understood to have been the reduction of the cost of construction —a purpose, be it added, which he signally failed to achieve. Owing to various causes, amongst which is included the protracted period of construction referred to above and to others for which the engineer cannot be held blameless, the cost of the installation has been high, and cannot be taken as a criterion of the cost of future installations. The capacity of the tanks is the same as at Conway, namely, 600 bags of mussels per week. The fishery is capable of producing enough mussels to keep the tanks fully employed.

The Lympstone tanks were put into commission in September, 1923. A good supply of mussels was forthcoming at the outset, fairly good prices being obtained. The quantity of mussels soon began to diminish, however, and in the latter half of December, none were brought to the tanks.

Amongst the causes contributing to this falling off the following may be enumerated :—

(1) Dumping of Dutch mussels, at a price equivalent to 4s. 6d. per English bag.

(2) Diminished purchasing power of the mussel consuming population.

(3) High railway rates.

(4) The counter-attraction of herring and other fishing, which was unusually remunerative this year.

(5) The disabilities inseparable from the restarting of an industry closed down for some years.

From a technical point of view, the tank installation proved satisfactory. Certain faults, revealed by tests prior to the opening of the season, were rectified. Thereafter, with the exception of certain pumping difficulties, which were quickly remedied by small structural alterations, the plant worked smoothly.

Several batches of mussels were subjected to particularly searching bacteriological tests, which showed that the results of cleansing were entirely satisfactory. As in the past, tests of uncleansed mussels showed them to be excessively polluted.

A slight modification in the cleansing technique was adopted, as a result of special local conditions. A proportion of the Lympstone mussels are coated with a thin film of apparently sun-baked mud, perhaps half a millimetre in thickness. This cannot be washed off by hosing, and can only with difficulty be removed by scraping. Further, in the early part of the season, the mussels from certain layings carry a considerable growth of green seaweed (*Ulva* and *Enteromorpha*). It is impossible for the fishermen, without the expenditure of an impracticable amount of labour, to remove the whole of this, a small amount being liable to remain entangled with the byssus. Bacteriological tests showed that the cleansing was not demonstrably prejudiced by such foreign matter. However, to provide an unquestionable factor of safety, it was decided to subject the mussels on the last day of cleansing, to a solution of " Chlorine " of 10 parts per million, instead of 3 parts per million as at Conway. Repeated tests showed that the excess of chlorine in no way prejudiced the mussels as regards taste or otherwise.

The Lympstone fishermen wished to convey their mussels to and from the tanks in horse-drawn carts. As, however, their boots were liable to get fouled with horse-droppings in the tank enclosure, horses were excluded, the mussels being carried from the gate to the tanks by hand. In order to prevent any horse-droppings being carried from adjacent roads into the tanks, the fishermen are required to sterilise their boots, with a strong " chlorine " solution, every time they enter the tanks. It may be added that, though horse-droppings are probably not, as a rule, liable to convey bacteria harmful to man, their presence, apart altogether from general considerations of cleanliness, may stultify bacteriological tests of cleansed mussels.

An interesting observation was made on certain deep-water mussels, which carry a thick growth of sponge. It was found that this sponge was liable to contain large numbers of sewage organisms, and that, as might be expected from a consideration of its structure and physiology, the pollution was not removed by the cleansing process. These mussels were therefore excluded from the tanks. This inflicted little or no hardship on the fishermen, as these particular mussels only occur in small numbers on a certain deep-water bank, from which the men dredge them, to the extent of one or two bags, if they happen to be passing.

Prior to the opening of the season, the Ministry consulted the Ministry of Health, with regard to the placing " out of bounds " of certain beds in the immediate vicinity of sewer mouths. The Ministry of Health agreed on certain areas, which after careful delimitation were closed by an Order issued by that Ministry. Such closure inflicts no hardship on the fishermen, as the mussels in question have no market value.

Extension of Conway System of Mussel Cleansing to Polluted Mussels in General.

In considering the application of any system of cleansing, it is essential that it shall not only be satisfactory from the point of view of public health, but that it shall be a sound economic proposition from the point of view of the industry.

After extended trial on a commercial basis, the method adopted by the Ministry at Conway has been proved to do all that was expected of it. But every cleansing station, large or small, involves certain expenses for maintenance which do not vary to any considerable extent with the size of the station. If, as has always been the intention, cleansing stations are to be self-supporting, the revenue from fees must be sufficient to pay these expenses, and that can only happen if the output of the fishery reaches a certain level, which, on the basis of a cleansing fee of 1s. per bag, is estimated at 10,000 bags per annum at the very least.

The aim which the Ministry originally set before it was to secure that all mussels placed on the market for human consumption should be above suspicion of contamination. This was necessary not merely to protect the public health but to protect the fisheries against scares. With a view to considering to what extent this policy could be carried into practice, an extensive series of surveys of various mussel fisheries was undertaken, and, in particular, inquiries were made as to the degree of pollution to which they were subject, the actual and potential production, the condition of the mussels and the possibility of improving it by transplantation, what sites were available and most suitable for tank installations, and what were the facilities for transport and organisation. Some of these surveys were of an exhaustive character, and the information collected will be of future value.

One thing which speedily became clear was the importance of cultivation. The number of Fisheries with an existing assured output of as much as 10,000 bags a year was small; others potentially capable of maintaining such an output have fallen off, for various reasons, among which were neglect of transplantation, ill-advised transplantation, excessive and unintelligent fishing, and the existence of adverse natural conditions. There were also other small fisheries which, owing to the unsuitable character of the surrounding grounds, were incapable of any considerable development, although the local fishing population attached importance to them as providing a convenient fishery in the nature of a side-line during the bad weather of the winter months. These small fisheries, many of which are seriously polluted, present one of the most difficult problems with which the Department is confronted in this connection. In some cases the endeavour has been made to organise in connection with them a trade in mussels to be used exclusively for bait. The possibility of grouping some of them with a view to the cleansing of their output at a central station has also been carefully considered, but the difficulties involved in the cost of carriage and handling have proved an insuperable bar. The provision of small tanks for cleansing purposes is impracticable because of the difficulties of adequate supervision except at a prohibitive cost. The whole question is further complicated by the difficulty of securing adequate protection for cultivated mussels in public waters, and, in particular, of giving the fishermen rights of property in the mussels they relay. To meet this difficulty the Ministry took powers under the Defence of the Realm Act (Regulation 2 UU) to secure for the fishermen rights of property in such mussels, but these powers lapsed at the end of August, 1923, and, as a rule, the men have been too apathetic or have had too little confidence in their permanence to avail themselves of the opportunity afforded by them.

Public Health Aspects.

During the period under review, numerous bacteriological tests of cleansed mussels have been made, the results being satisfactory and fully in keeping with those referred to in the last Report.

The method of cleansing employed is also justified by practical experience. Before the closure of the fishery, when mussels were sent straight from the Conway Estuary to the markets, complaints of illness caused by their consumption were of frequent occurrence. It is stated that such complaints were approximately at the rate of one per week during the mussel season. During the seven years the Ministry's cleansing tanks have been in operation not one complaint has been received from Public Health Authorities or elsewhere.

It may be mentioned that on a few occasions the fishermen have received notices from the markets that their mussels have been condemned by the market authorities as unfit for human consumption, and destroyed. In all these cases it was clear from the nature of the official notice that the mussels were condemned on account of their having become stale or putrid through long keeping, etc. However, to satisfy the fishermen, inquiries were made of the Health Authorities who confirmed the above reason for condemnation, *i.e.*, delay on rail, or in sale, leading to death and decomposition. Reference is made to this matter as the condemnations in question have led in certain local quarters to the hasty conclusion that they were due to pollution having been detected, or that the mussels were spoiled by " chemicals " used in cleansing.

As might have been expected, the criticism is sometimes heard in uninformed quarters that as " chemicals " are used, they must perforce spoil the mussels by giving them a taste. It is notable, however, that there is no record of such complaint originating with the dealers, either wholesale or retail, or with the consumer. This question was referred to in the previous Report, p. 94, but it may be desirable again briefly to touch upon it. For the cleansing of the mussel itself, that is to say, apart from the outside of the shell, exposure to two changes of sterile water, each for a period of not less than one night, is relied upon. At this stage the chlorine used in sterilising the water exists only in the form of sodium chloride (table salt) in extremely minute quantities, that is to say, a few grains per ten thousand mussels, and can have no effect of any kind. In the final stage, the mussels are exposed for one hour to sea water containing three parts per million of active " chlorine " to sterilise the outside of the shells. As soon as the chlorinated sea water reaches the mussels it begins to run down in strength, that is to say, it is fixed in an inert form and, owing to its minute quantity, imperceptible to taste. The rate of running down varies with various factors, such as sunlight, etc., but in any case by the time the mussels reach the market all trace of active chlorine has disappeared, and this applies also to the sacks sterilised with " chlorine."

With regard to the possibility of any active chlorine penetrating inside the shells during the last stage of treatment, it may be taken as a general rule that the chlorine retains its strength during the hour of treatment sufficiently to prevent the mussels opening. On occasion, some of the mussels are observed to be slightly open, and more rarely, apparently all may be in that state, by the end of the hour's treatment. It is, however, only when the strength of " chlorine " has fallen well below one part per million that this occurs, and the mussels do not function properly and pass a stream of water through themselves until the " chlorine " is so weak as, if present at all, to be almost imperceptible to the most delicate chemical tests (say one-fifth to one-tenth part per million). In other words, the opening of the shell is in itself no criterion of the functional activities of the mussel. In any case, however, there is evidence that a certain amount of active " chlorine," even in a concentration strong enough to kill bacteria (say one part per million) may, on occasion, enter the mantle cavity of the mussels, by diffusion, if not by direct current. From a practical point of view such entrance of " chlorine " is all to the good. It has been recognised, of course, since the cleansing of mussels at Conway was begun that their final exposure to sea water containing active " chlorine " was not only an intrinsic part of the process as regards the outside of the shells, but that it might assist in the cleansing of the inside of the mussel, at any rate as far as the mantle cavities were concerned. It was also recognised that it could not be relied upon in the latter capacity, and that if exposure to active " chlorine " were practised during the stages designed for the cleansing of the inside of the mussel, it was liable to be a source of danger by giving a false sense of security.

It would be out of place here to enter into detailed discussion of this question, as it is a complicated and highly technical one. Suffice it to say that, generally speaking, the addition of active " chlorine " to the water, in strengths likely to ensure an enduring bacteria destroying action, interferes with the functioning of the mussels, and may interfere with, and even prevent, cleansing. On the other hand, if " chlorine " be added in such strengths, that it may be assumed not to interfere seriously with functioning, its action in destroying bacteria is negligible not only on account of its low strength, but because that strength rapidly runs down to zero. There is thus little or no object in adding these minute amounts of chlorine, and in point of fact, cleansing results obtained are no better than if sterile water only be used. To maintain a constant minimal charge of " chlorine " in the water would be of doubtful utility, and extremely difficult to accomplish. Any routine system on a commercial scale depending on automatic or other devices to ensure constant strength would be bound to be punctuated by a series of " accidents " such as overdosage, &c., which might have disastrous results.

It goes without saying that from a Public Health point of view any practical system of cleansing must be free from the possibility of accidents, such as those indicated above, and must at the same time be so simple as to be practically fool proof. For this reason, the part taken by " chlorine " in assisting to cleanse the inside of the mussel during the last stage of the process has not hitherto been referred to in descriptions of the routine procedure inasmuch as, if of any value at all, it is capricious in action and impossible to control.

Before concluding this section, the Ministry's views with regard to the value of routine bacteriological examinations as a means of controlling the cleansing process may be given.

A system of cleansing in tanks has been evolved. It is claimed that certain results can be achieved by it, such claim being based on the fact that exhaustive bacteriological tests carried out over a period of nearly ten years, under all possible conditions, have established this.

That being so, the logical way to control the system is to ensure that the process is properly carried out in every detail.

It is clear that if, after making sure that the process is being satisfactorily performed at every step, the mussels immediately after leaving the tanks, and before any possibility of chance pollution in transit to the consumer, are found to contain objectionable bacteria in excess of permissible numbers, then the whole process stands condemned, for it is clearly impossible to find a remedy.

Such a state of affairs has not arisen, however.

It is not contended, of course, that bacteriological examinations at intervals have not their legitimate place, but it is contended that the process cannot be *controlled* by them, if, at the same time, it is known that it is being carried out efficiently strictly according to rule.

Further, assuming for the sake of argument that bad batches of mussels are a possibility from time to time, it is impracticable to protect the markets by routine bacteriological examinations, inasmuch as the mussels are marketed and perhaps consumed before the results of tests can be available.

It is recognised that an odd mussel may escape cleansing. For instance, an injured mussel (*e.g.*, one " stunned " or injured by having the byssus torn out) may not open in the tanks. This is a risk which must be faced if the process is to go on. To meet such possibilities, heavy penalties are provided and strictly enforced (*i.e.*, confiscation of mussels and exclusion from the tanks) against any fisherman roughly handling his mussels or tearing off the byssus. The possibility has been established in the laboratory, but such mussels have not been found amongst any samples, taken at random from the tanks for analysis, so far. The risk is further minimised by the fact that an injured mussel, though it may remain closed for a few days, is likely to gape before it reaches the consumer, who would probably reject it.

OYSTER CLEANSING AND BREEDING EXPERIMENTS.

Oyster Cleansing.

In the last Report* (p. 97) reference was made to the cleansing of oysters, which had been found to be amenable to ready cleansing under favourable conditions. A caveat was, however, added with reference to the susceptibility of oysters to frost and sudden changes of temperature, and the need for further experiment. A scheme for the erection of small experimental tanks, designed to furnish the data necessary to place commercial cleansing of oysters on a sound basis, was worked out in 1919. There was some diversity of opinion as to the best situation of the tanks. Dr. Lyster Jameson, the Ministry's Adviser on Inshore Fisheries, was strongly of opinion that, for various reasons, experiments should be conducted on the Thames Estuary, preferably in the neighbourhood of Whitstable, in conjunction with oyster breeding experiments on a large scale. An advisory Oyster Research Committee, including prominent members of the Oyster Merchants and Planters' Association, was appointed in 1920, and the whole question thoroughly explored. It was recommended that the experiments should be conducted near Whitstable, and a detailed scheme, including the provision of tanks and laboratory accommodation, was worked out and approved by the Committee. Various considerations, amongst which the most cogent was the need for economy, militated against the materialisation of the scheme, which ultimately fell through.

The appointment of an assistant bacteriologist for the special purpose of investigating oyster cleansing problems was approved by the Treasury in 1920. Such an officer was appointed in the autumn of that year, but circumstances made it necessary to employ him on a special inquiry elsewhere, and his services did not become available at Conway until early in 1921. Small tanks (some 40 to 50 gallons capacity) were constructed and experiments were begun, but the lateness of the season, and the makeshift nature of the installation, prevented any material progress being made in the solution of the main problem. Very valuable research work on the bacteriology of the oysters was, however, carried out, and is referred to elsewhere in this Report. This phase of the work was terminated by the departure of the officer in question, in April, 1921, on his appointment to another post. The vacated post was not refilled until September, 1922.

It had been realised from the outset that reliable results could only be obtained from experiments carried out under conditions similar to those which would occur in commercial cleansing, and in 1921 a scheme was approved for the construction of suitable tanks at Conway. The installation of the tanks was delayed owing to their having to wait for the completion of oyster breeding tanks and other delays, which appear to be inevitable in constructional work since the war, occurred. The installation was begun early in 1922, and completed in the summer of that year. It consists of a " battery " of four small tanks, 25 feet square and 3 feet deep. Two of these are enclosed each in a separate shed with well insulated walls and roof, a hot water circulation heating apparatus being installed. The object of these tanks is to ascertain the minimum and optimum temperatures at which oysters can be relied upon to cleanse themselves. The water is heated to the desired temperature in the upper tank, and after sterilisation is run into the lower tank, the water being kept at its initial temperature by maintaining the air of the shed at that temperature. The other two tanks are identical with those just described, with the exception that they are uncovered and unheated. They are designed for control experiments. All four tanks, in common with the oyster breeding tanks, are specially constructed to function as accessory mussel cleansing tanks when available, and they are invaluable for general biological experiments.

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* For particulars see cover.

Unfortunately, serious structural defects developed in the tanks, and it was further found that the anticipations of the engineer responsible for the design had been somewhat optimistic. As a result, much of the season of 1922-23 was taken up in rectifying these matters. In a sense it was fortunate that the winter was unusually mild, as in any case it would have been impossible to carry out low temperature experiments. In spite of the numerous disabilities enumerated, valuable data have been accumulated. Experiments in 1921 seemed to show that the mucus of the oyster exerted a powerful inhibitory action on bacteria of the *B. coli* group. Further experiments on the same lines, carried out in 1922, do not appear entirely to confirm the previous observation. Further experiment is required before a definite verdict can be given. Such cleansing experiments as it has been possible to carry out in the new tanks tend to show that the optimum temperature for cleansing is considerably higher than was at first thought probable, as the result of early experiment. Here again further experimentation is required. One fact emerges from all the experiments, and that is that the degree of pollution of oysters from a given ground, as estimated by the ordinary *B. coli* tests, is lower than that in the case of mussels from the same ground. To such an extent is this the case that the pollution of oysters laid down in a " parc " constructed on the Conway River foreshore, was found to be so low at times, and so capricious, that it was deemed advisable to obtain polluted oysters for experiment by placing them in a tank heavily polluted with sewage brought from one of the sewer mouths. The problem of the cleansing of oysters is by no means such a simple one as the cleansing of mussels, and much further experimentation is necessary before the essentials of a sound and safe commercial process can be evolved. The spade work already done indicates the lines on which such experimentation should proceed.

Oyster Breeding.

In the last Report* (p. 97) certain investigations in connection with the breeding of oysters at Conway were alluded to. These investigations have been continued, with gratifying results. Annual Reports on the progress of this work have been issued to the members of the Oyster Merchants and Planters' Association and others interested in the subject, the general opinion expressed being that it is highly desirable that the experiments should be continued, inasmuch as they promise far-reaching benefits to the industry. These Reports, though short, are too lengthy for reproduction here, but a brief résumé may be given.†

In the summer of 1918, in one of the tanks a heavy settlement of oyster spat occurred, derived from about a dozen oysters which had originally been obtained for cleansing experiments early in 1917, and which remained in the tank on the chance of their being again used for similar experiments. The majority of the spat, some 1,000,000 in number, and ¼ in. in diameter, adhering to the walls and floor of the tank, had to be sacrificed in September owing to the opening of the mussel season and to the necessity of using chlorine in the tank. Forty oysters adhering to a slate were preserved and kept in a chlorine-free tank, and by September, 1919, had grown to marketable size, viz., 3 to 3¼ inches, increasing to 4 inches in 1920.

As the 1918 spat indicated great possibilities for tank cultivation, the experiment was repeated in 1919, a settlement of spat being obtained late in the season, chiefly on slates used as collectors. These slates were wintered in the storage tank, but were exposed to such vicissitudes of temperature and varying salinity, owing to the exigencies of the mussel cleansing operations, that a large percentage was lost. The survivors subsequently developed with a rapidity little short of that of the 1918 spat.

In 1920 a further experiment was carried out, slates, tiles, brushwood, mussel shells, &c., being used as collectors. A phenomenally large spat was obtained in three of the four tanks. An idea of the density of the settlement may be obtained from the fact that many average sized mussel shells carried over 100 young oysters. Again, owing to the opening of the mussel cleansing season, the tanks had to be cleared by September. A considerable proportion of the spat was saved, some being kept in wire cages in the Conway Estuary, and in a neighbouring estuary, some was taken to Whitstable and a certain amount kept in the storage tank. The last did badly, as in 1919, but such of the transported spat as had a reasonably fair chance did well, showing that tank-bred spat is suitable for the replenishment of natural beds, under favourable conditions.

It should be pointed out that up to this stage (end of 1920) the oyster work had been entirely a side line, and that it could not be described as a piece of scientific research, inasmuch as it had been impossible, owing to deficiency of staff, to give it the attention which would have been necessary were it to be dignified by that title. In 1921 it was thought advisable, in view of the good results obtained for three successive years, to attempt to produce spat on a commercial scale, with a special view to rendering assistance to oyster planters whose layings had been depleted by the heavy mortality which had occurred at various points on the coast. This course was very strongly urged by the late Dr. Lyster Jameson, Adviser on Inshore Fisheries to the Ministry and to the Development Commissioners. Fifty thousand collecting tiles were imported from Brittany (the then price of English tiles being altogether prohibitive) some of which, after being coated with lime and wired into clusters of twelve (French bouquets) were placed in the tanks. Unfortunately, owing to a series of circumstances over which it was impossible to exercise any control, a series of regrettable delays had occurred. The shipload of tiles did not arrive until the end of June, and the tiles were not ready for use until mid-July. The main spat was therefore missed. A few oysters were secured from later and feebler spats, but not in quantities sufficient to be of any material use on a commercial scale. A good settlement of spat was obtained on slates and other collectors placed in the tanks for experimental purposes before the tiles were ready. Most of the available spat was wintered in two special tanks (25 feet by 25 feet by 5 feet), which had been constructed in 1921 for the purpose, the mortality being negligible. A few bouquets of tiles bearing spat were deposited in the autumn of 1921 in the Conway Estuary, but though the oysters survived the winter, they were greatly handicapped in the spring, as in previous springs, by an excessive growth of barnacles. The oysters wintered in the tanks were taken in the spring to the Menai Straits, where they have thriven remarkably well.

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* For particulars see cover.

† A full report on these investigations is in preparation and will shortly be issued.

In 1922 preparations were again made for collecting spat on a commercial scale. Unfortunately, the season was entirely blank owing to the fact that the oysters did not spawn. This experience appears to have been almost, if not quite, universal; reports of a failure of spawn having been received not only from the majority of the English and Scottish grounds, but from those of Holland, Denmark and France. No positive result has been noted. The negative result clearly has no bearing on the question of the feasibility of rearing oyster embryos in tanks, that is to say, upon the main problem which the Conway experiments are designed to solve. It seems reasonable to attribute the absence of spawn to the persistent low temperatures which were experienced during the spring and summer of 1922, both at home and abroad.

In 1923, in contrast with 1922, there was abundance of spawn, but only a very meagre settlement of spat was obtained. There is no reason to suppose that low temperatures were responsible for this result. An attempt was made, by varying the conditions in the different tanks, to ascertain the influence, if any, of certain factors on the settlement of spat. Thus, the effect of sterilising the water, with subsequent addition of food, in the form of diatom cultures, was tried. Further, waters of different salinities were used, and the effect of aeration of the water, and the reduction of the alkalinity was explored. There was, however, judging by control experiments, no evidence that these measures exerted any influence whatever.

The net result of these experiments to the end of 1923 is that for four years in succession good spats have been obtained in the Conway tanks, two of them having been phenomenally good. There would, therefore, appear to be reason to believe that tank culture carried out under conditions similar to those at Conway will prove a valuable asset to oyster culturists, in view of the well-known fact that spat settlements under natural conditions are extremely capricious and unreliable. The fact that the fifth year was blank, and the spatfall in the sixth year was poor, does not stultify this contention for reasons given above. The failure of natural spatfall is, of course, as often as not independent of the spawning or non-spawning of the oyster. The reasons for the success of the Conway oyster breeding experiments are as yet obscure. The fact that in certain seasons heavy spats were obtained in tanks, the walls and floors of which had been sterilised with chlorine, whilst no spatfall occurred in tanks not so treated, points to the possibility of this sterilisation being the secret. This might well be the case, hitherto unidentified enemies of the oyster being destroyed. The water in which the oysters have been bred has not been sterilised, being pumped direct from the Estuary. At first sight it might appear that this would negative the theory that the destruction of " enemies " is the explanation of the success attending the experiments. It is clear, however, that in the case of the large storage tank, which is filled daily from the river with unsterilised water, the walls and floor may carry, in the material adhering thereto, either oyster " enemies " or their eggs or spores, derived from any one or all of the previous fillings. These, if they exist, have been eliminated in the tanks in which successful spatfall has been obtained. The " enemy " theory is, however, not proven, and there are many points against it, which are too lengthy to discuss here. There is, however, no question that rigorous cleanliness throughout the experiments is a *sine quâ non.*

Organisms hostile to the oyster have been carefully looked for, but the only one so far definitely identified is the small " phosphorescent " organism, *Noctiluca* (see " Nature " of 9th September, 1922). It is more than doubtful whether it was responsible for the spat failure in certain tanks, although it was noted in small numbers in the water.

It was proposed after the large spat of 1920 (incidentally, the year in which the difference between the sterilised and unsterilised tanks was most marked), when facilities for observation were improved, and additions made to the staff, to make a special study of the conditions governing the spawning of the oysters, and the spat settlement in the tanks, a scheme for a series of experiments with controls in the various tanks being worked out. As pointed out above, however, it was decided to aim at getting as large a spatfall as possible to assist in replenishing the depleted fisheries, and in 1921-22 the experiments were carried out in all the tanks under similar conditions, that is to say, those which previous experience had indicated as being the best.

In 1923 a beginning was made in the exploration of certain conditions which might influence spawning, and, as indicated above, the settlement of spat. The results were, however, negative, merely emphasising the fact that the factors determining the settlement of spat, which are of such paramount importance, are, so far, to all intents and purposes, a closed book. A study of the somewhat voluminous literature on the subject fully confirms this view. The problems in question, and many others, await solution, and the answers are essential for an understanding and successful prosecution of oyster culture. They will only be forthcoming after much patient research. As yet only the fringe is touched, and years must elapse before we can hope to be in possession of the whole story.

A programme for the further prosecution of experiments in feeding, and the effects of aeration, varying salinities, artificial heating of the water, etc., has been worked out for 1924.

Oysters bred in the Conway tanks have been transplanted to natural beds on the north foreshore of the Menai Straits. They have developed very satisfactorily, reaching in one year a diameter of 2½ inches. Moreover, they are of good shape and very well fished, that is to say, of excellent market quality. The cycle from spawning in the tanks to the production of the oyster of commerce has been completed, though only on a small scale.

PRODUCTION OF SHELL-GRIT FROM THE SLIPPER LIMPET (*Crepidula fornicata*).

The origin and development of the Ministry's operations in connection with the manufacture of shell-grit for the use of poultry were described in the last Report.*

It is with regret that the Ministry records the death, on 26th February, 1922, of Dr. H. Lyster Jameson, its Technical Adviser on Inshore Fisheries, to whom alone credit is due for the initiation of the enterprise. The establishment and maintenance of the factory at West Mersea during the war period were accomplished in the face of unusual difficulties. Some of these were referred to briefly in the last Report, and it was entirely due to the ability, energy and foresight of Dr. Lyster Jameson that successive obstacles were so far overcome or avoided as to achieve for the scheme a measure of usefulness and success which, in spite of a fairly substantial cash loss, amply justified its maintenance.

During the first two years of the period covered by this Report the financial position of the Ministry's shell crushing factory at West Mersea was very satisfactory, the profit in the second year amounting to £135, after allowing for all charges, including interest on capital. In January, 1921, the opportunity afforded by the accumulation of a considerable reserve of the finished shell-grit was taken to suspend production, discharge the majority of the employees at the factory and undertake a thorough overhaul of the plant. This operation included the substitution of a new rotary dryer for the somewhat unsuitable and antiquated machine originally installed, which was the only one immediately obtainable when the factory started work. It was anticipated that with the new machinery, which was far more efficient and more economical that the old, a substantial profit would be secured for the year 1921-22.

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* For particulars see cover.

This hope was not, however, fulfilled as during the year business decreased and a loss was incurred. This falling off may be attributed to three causes. In the first place, the sale of grit was seriously affected, like that of most other products, by the general trade depression. Secondly, the crushed limpet shell had to contend with the very keen competition of American oyster-shell grit which was imported, generally as ballast, in increasing quantities and at a decreased price, and this necessitated the sale of some of the existing stocks which had been prepared prior to the installation of the new and more efficient dryer, at prices below the cost of production. The third cause can be found in the policy of the Government. It had been the Ministry's intention to embark upon an extensive campaign to popularise the use of the British product, but the decision of the Government to abandon all schemes of State trading, whether successful or not, brought about an entire change of policy. The scheme for advertising the product was not proceeded with, no further supplies of raw material were purchased, and the output of the factory was restricted to the minimum necessary to fulfil any orders which came in. In these circumstances, the output of the factory during the year 1921-22 showed an enormous decrease on that of previous years.

Despite the loss incurred during the year 1921-22 the financial results of the venture down to March, 1922, were not unsatisfactory. During the period August, 1916 (when operations were commenced) to March, 1921, a total profit of £508 was made, against which must be placed a loss of £796 during 1921-22, leaving a net loss for the whole period of £287. It should be borne in mind, however, that this loss is arrived at after charging a sum of £762 10s. 0d. as interest on Treasury advances, and that had the undertaking been financed in the ordinary way by capital subscribed by shareholders, the difference between these two sums, viz., £475 10s., would have been available for distribution as dividend.

It must also be remembered that, as explained in the last Report, the purpose of the shell-grit factory was not to make profits but merely, if possible, to pay part of or all the cost of combating, especially on the public grounds, a pest which threatened to destroy the oyster fisheries. It is important to call this fact to mind for two reasons. In the first place, the general public is apt to regard any form of State trading with suspicion. In the second place, with the sale of the factory, the control of the pest would cease to be the main object of the maintenance of the concern. Already the difficulty of securing the main object for which the factory was maintained was demonstrated by the fact that during 1920-21 it was no longer possible to obtain supplies of limpets from the public grounds owing to the attitude of the Local Fisheries Committee. The Committee maintained that the removal of limpets from the public grounds infringed their bye-law which prohibits the taking of any cultch, since it is not possible to remove limpets without also removing a small amount of cultch. As a result of the Committee's attitude, supplies of the raw material had to be obtained from private oyster companies in the neighbourhood who were only too glad to be able to find a market for the limpets taken from their own grounds.

As a result of the Government's decision referred to above, the Ministry took steps to dispose of the factory and ultimately sold it early in 1923 to a local company formed for the purpose of carrying on the business. The company was unable to secure a renewal of the tenancy of the factory but a site was secured in the West Mersea district in close proximity to the water's edge. As was anticipated, this enforced sale produced a very considerable loss, firstly, because the price of the machinery had fallen far below that obtaining at the time of purchase, and, secondly, because an examination of the balance sheet by possible purchasers immediately revealed the fact that, owing to unsuitability of the site for transport purposes, the relatively large capital employed and the low output in comparison to the factory's capacity, the costs of production were so high under the existing circumstances as to render profitable competition with the American grit impossible.

It was almost inevitable that the output should still further decrease during 1922-23 while negotiations for the sale of the factory were in progress, and the balance sheet showing the financial position of the undertaking, after completion of sale and after claims had been met for dilapidations, accordingly shows a total loss of £3,623. The enterprise has, however, fully demonstrated that the slipper limpet pest can be turned to commercial use, so as in part to pay for the cost of controlling it, and, at the same time, that there can be produced from it a native poultry grit which is equal, if not superior, to the American product.

In the year 1919-20, 1,930 tons of raw material were purchased, for which payment of £1,052 5s. 0d. was made to the fishermen, exclusive of additional bonuses on the 1919-20 catch paid in 1920-21. 783 tons of the finished product were manufactured, £4,645 being realised by sales.

In the year 1920-21, 1,509 tons of raw material were purchased at a cost of £1,092 and 741 tons of the finished product were manufactured, the sale of which realised £4,558.

In the year 1921-22 practically no raw material was purchased, the stock on hand being utilised to meet the demand for the finished product, which amounted to 301 tons and was sold for £1,819.

During the year 1922-23, sales of grit amounted to £634 and of raw material to £163, most of which was taken over by the purchasers of the factory.

The following statement shows the financial position of the limpet shell-grit enterprise after the completion of the sale of the factory.

PRODUCTION OF SHELL-GRIT FROM THE SLIPPER LIMPET.

Balance Sheet as at July 25th, 1923.

	£	s.	d.		£	s.	d.	£	s.	d.
Exchequer Issues	3,243	4	11	Plant and Machinery :—						
Headquarters' Administrative Expenses Account	670	0	0	Valuation as at 1st April, 1922	2,251	12	6			
Interest Reserve (See Note 1)	1,428	10	0	Less Sales ... £450 0 0						
Insurance Account	86	0	0	Depreciation and loss on Realisation ... £1,801 12 6						
Sundry Creditors (See Note 2)	2	2	0		2,251	12	6			
				Sundry Debtors (See Note 2)				3	4	0
				Profit and Loss Account (See Note 3) :—						
				Loss brought forward 1st April, 1922	2,090	8	11			
				Add loss for present period (trading loss and loss on realisation)	3,336	4	0			
								5,426	12	11
	£5,429	16	11					£5,429	16	11

Note 1.—Interest has been calculated (1) on Fixed Capital at Bank Rates ruling when expenditure was incurred, and (2) on Working Capital at Bank Rates current during period of this account. *Interest has been calculated to 20th January, 1923, i.e., date when trading ceased.*

Note 2.—Sundry creditors and debtors have been cleared since the date of this account.

Note 3.—Of this loss, £1,803 3s. 5d. is due to experimental expenditure incurred prior to the manufacture of poultry-grit (*i.e.*, crushed limpet shell) in August, 1916, so that the actual loss on trading and realisation from that date to 31st March, 1923, stands at £3,623 9s. 6d.

CHAPTER VIII.—PROCEEDINGS UNDER ACTS, CONVENTIONS AND INTERNATIONAL LAW.

Orders under the Defence of the Realm Act in connection with Sea Fisheries.

With the exception of the Oyster (Close Season) Order, 1918 (Sea Fishing Order, No. 5), which was repealed on 17th June, 1919, all the Sea Fishing Orders made by the Ministry under powers derived from the Sea Fishing (England and Wales) Order, 1917, made by the Food Controller under the Defence of the Realm Act, which were referred to in the last Report,* continued in force up to 31st August, 1921, the date of the official termination of the war.

Sea Fisheries Regulation Act, 1888.

The Statutory Annual Meetings of Representatives of Local Fisheries Authorities were held in each year. Reports of the proceedings at the meetings in 1919 and 1920 will be found in Cmd. 373 and Cmd. 999 respectively, the report of the proceedings at the 1921 meeting being issued as a Stationery Office publication, price 1s. 6d. The report of the proceedings at the 1922 and 1923 meetings were issued by the Ministry in typewritten form.

During the discussion at the 1921 meeting of the question of the relationship of Local Fisheries Committees to one another, a desire was expressed by the representatives of the Sussex Committee that, wherever possible, the bye-laws in force in neighbouring districts should be uniform. Hitherto, the difficulty had been to get all the Committees to come together to discuss controversial points, but at the meeting all representatives of Committees having jurisdiction in the English Channel agreed, on the invitation of the Minister, to meet at the Ministry. The Conference, which was held on the 23rd September, 1921, was attended by representatives of the Kent and Essex, Sussex, Southern, Devon and Cornwall Sea Fisheries Committees.

Early in the proceedings it was suggested that general uniformity of bye-laws in the Channel was impracticable owing to the widely different conditions obtaining in the various districts, but that the Conference might usefully consider whether the preservation of the stocks of fishes might best be secured by closure of specific areas either all the year round or for specified seasons, or by regulating the size of meshes, or by other means. That is to say, the question of method might be discussed apart from the local application of it. Local regulations must obviously be discussed in the light of local circumstances, and, before a decision as to closure of an area could be arrived at, scientific investigations would as a rule be necessary.

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* *Fisheries in the Great War*, being the Report on Sea Fisheries for the Years 1915 to 1918. (For particulars see cover.)

As regards the mesh of nets, it was agreed that while the methods of measuring the mesh should be uniform, the size of the mesh must depend on local conditions obtaining in each district.

It was also agreed that there ought to be uniformity as to the protection of **berried lobsters.**

The question of a uniform **minimum size of lobsters** allowed to be taken in the English Channel was fully discussed. It was pointed out that a uniform minimum size would simplify the enforcement of the law, especially if, in any future fisheries legislation, power were obtained to prosecute offending shop-keepers. The Kent and Essex representatives, however, urged that lobsters in their district were smaller than the other Channel varieties and the discussion resulted in the proposal for uniformity in this respect being negatived.

An agreement with regard to the **close time for periwinkles**—an important matter in the Southern and Sussex districts—had already been arrived at between the representatives of the Committees for those districts, but local conditions prevented the other Committees from conforming to the agreement.

A motion for a **uniform size limit of five inches for crabs** resulted indecisively.

In a discussion on the **method of restricting trawling** it was shown that conditions varied so much in the different localities that uniformity in the restriction of the length of beam or the otter head rope was impossible. The Conference was then asked to consider whether it might not be advisable to attempt uniformity in the method of regulation. In some cases trawling is regulated by bye-laws restricting certain methods of propulsion, such as motor engines, whereas in other cases the bye-laws regulate the length of the beam and the otter head rope, or the length of the vessel. A uniform use of either the one or the other method of regulation might go a long way towards simplifying the difficulties of fishermen working in two or more districts.

It was argued, however, that although a limitation of future legislation to the regulation of the length of the beam or of the head rope of the otter trawl might encourage the use of motors in inshore vessels, a small beam or otter head rope might not succeed in keeping out the powerful steam vessel.

The general feeling of the Conference was in favour of waiting until a decision was reached about a proposed Sussex bye-law prohibiting the use of any trawl with a beam exceeding 30 feet or with an otter head rope exceeding 45 feet, before taking any action.

Sea Fisheries Act, 1868 (Part III).

The usual report rendered in pursuance of Section 50 of the above Act having been omitted from the Ministry's last Report on Sea Fisheries, the present Report covers the years 1915 to 1923 inclusive.

The two applications for Orders noted in the Annual Report for 1914 (page xxviii) as outstanding at the close of that year were duly proceeded with, and as a result the Cardigan Bay

Mussel Fishery Order, 1915, and the Poole Fishery Order, 1915, were made and confirmed by Parliament in 1915. The Grantees of these Orders respectively were the Lancashire and Western Local Fisheries Committee and the Southern Local Fisheries Committee.

Both Orders include provisions not previously incorporated in any Order under the Act of 1868. The Cardigan Bay Order is a " regulating " Order, *i.e.*, it confers upon the grantees a right of regulating the mussel fisheries within the area to which the Order applies. Provisions were, however, included with a view to enable arrangements to be made for mussels taken from " special areas " within the fishery and intended for consumption as human food to cleanse themselves in " suitable and convenient places or receptacles for the deposit of such mussels," and for the issue of a notice specifying a date after which mussels from " special areas " intended for human consumption should not be taken except for the purpose of being forthwith deposited for cleansing. For various reasons, the Order has not been brought into full operation.

The Poole Fishery Order, 1915, which superseded the Poole Fishery Order, 1885, conferred on the Southern Local Fisheries Committee a right of regulating the fishery in oysters, mussels and cockles within an area in and near Poole Harbour, and contained provisions similar to those contained in the Cardigan Bay Mussel Fishery Order for enabling oysters or mussels taken in the fishery or any specified part or parts thereof and intended for consumption as human food to cleanse themselves. No notice has yet been issued under the Order prescribing a date after which oysters and mussels taken from the fishery for human consumption may not be sold except after such cleansing.

The Poole Order differs from all other Orders in that it has the form of a " several " Order as well as a " regulating " Order, provisions being included therein which enable the grantees to form and lease to fishermen layings for the cultivation of oysters, mussels and cockles. These powers have recently been exercised under the sanction of the Ministry and the Board of Trade, a number of oyster layings having been marked out at Shipstal Point and leased to the Poole Fishermen's Society. The scheme is, however, in the nature of an experiment, and was sanctioned for one year only in the first instance.

An application was subsequently received from the grantees of the Order for the Ministry's sanction to the renewal for a further year of the lease. The desired sanction was given.

In February, 1921, the Ministry confirmed two Regulations made under the Order. One of these enabled the grantees to specify the maximum number of oysters that might be taken from the fishery during any season or part of a season. The other practically re-enacted the " Poole Fishery (Oyster and Mussel) Order, 1919," as regards oysters, that Order having been made by the Ministry under Defence of the Realm powers, and lapsing after 31st August, 1921. (See " Fisheries in the Great War,"* page 115.)

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* For particulars see cover.

An application received from the Lancashire and Western Local Fisheries Committee in 1916 for the grant of a "regulating" Order in respect of the Morecambe Bay Mussel Fisheries, on the lines generally of the Cardigan Bay Order, was not proceeded with.

In 1920 the Ministry was called upon to issue a certificate under Section 45 of the Act of 1868, determining the right of several fishery in oysters conferred upon the Roach River Oyster Fishery Company by their private Act of 1866, on the ground that the Company had failed properly to cultivate the ground within the limits of their fishery. After an inspection of the ground, and consideration of all the circumstances of the case, the Ministry decided not to issue such certificate.

Two applications were received in 1922 for the granting of Orders conferring a right of several fishery, the one in oysters and mussels and the other in oysters. In the former case, the Seasalter and Ham Oyster Fishery Co., Ltd., applied for an Order in respect of an area on the Kentish Flats adjacent to their Ham Fishery off Whitstable. After due inquiry an Order was made and scheduled to the Oyster and Mussel Fishery (Seasalter and Ham) Provisional Order Confirmation Bill. The Bill, however, met with opposition on the Third Reading stage in the House of Commons, and was eventually thrown out on a division. The Order, therefore, cannot come into operation. The opposition was mainly instigated by fishermen on the Essex shore, who feared that the scope of their dredging operations would be interfered with by the allocation of a further area of sea-bed to the Seasalter and Ham Company. A second Inquiry was held (at Tollesbury) in order to enable the promoters to meet the objections, but they were not successful in securing the withdrawal of opposition.

In the second case, the Roach River Oyster Fishery Company applied for an Order to maintain them in possession of their existing fishery under the Roach River Fishery Act, 1866, the grant of a several fishery under that Act being apparently limited in duration to a term of sixty years by the passing of the Sea Fisheries Act, 1875. In this case also an Order was made and scheduled to a confirming Bill, which passed through all its stages and received Royal Assent on 31st July, 1923.

HERRING FISHERY (BRANDING) ACT, 1913.

When arranging for the resumption of herring branding operations after the war, it was considered necessary, in the light of experience, to revise the Regulations made in 1914 under the Herring Fishery (Branding) Act, 1913. Modified regulations were accordingly compiled, and were brought into force on 15th September, 1919. The principal alterations referred to the inspection and examination of barrels, marks on filled barrels, duration of "pining" or salting, description of brands and the method of branding.

In view of the Herring Guarantee Schemes operating in the years 1919 and 1920, and the control of the industry exercised by the Herring Fisheries Executive Committee in those years, the use of the Crown brand under the revised regulations was not required until 1921. During these years, however, all barrels of cured herring purchased by the Herring Fisheries Executive Committee on behalf of the Government were stencilled with the Crown brand, and as practically all these barrels were disposed of in the continental markets the Crown brand received a great advertisement, and foreign buyers got accustomed to it and recognised in it a high standard of cure. Consequently when the Government declined in 1921 to grant a further guarantee to the drift net fishermen there was a considerable demand for branding with the Crown brand in accordance with the regulations made under the Herring Fishery (Branding) Act, both at Lowestoft and Great Yarmouth. As branding had hitherto only been practised at Lowestoft, an Order was made on 4th November, 1921, bringing the Regulations made under the Act of 1913 into force at Great Yarmouth. New branding apparatus was found to be essential, and a series of experiments was made with the self-heating branding irons originally used by the Department of Agriculture and Technical Instruction for Ireland. The results of these experiments were favourable, and in practical use these self-heating irons were found to work in a satisfactory manner. On several occasions a single lamp has branded over 600 barrels without being refilled, and it is calculated that in the summer season that number could be increased to 800 or 1,000 barrels.

The numbers of barrels and half-barrels of herring branded at Lowestoft and Great Yarmouth during the 1921-22 season were respectively 28,669 and 3,569½, while the amount received in respect of fees at the former port was £477 16s. 4d. and at the latter port £59 9s. 10d.

During the season 1922-23, however, these figures fell considerably, the total number of barrels branded at Great Yarmouth being 3,312, the fees for which amounted to £55 4s. 0d., while the corresponding figures at Lowestoft were 74 barrels and £1 4s. 8d. in fees.

There has been no demand for the Crown brand during the season 1923-24.

A memorandum in Russian and German explaining the object of branding herrings with the Crown brand and advocating the purchase of herring bearing the brand has been distributed amongst possible foreign buyers.

CRAN MEASURES ACT, 1908.

The number of quarter-cran baskets used in the trade in fresh herrings which have been verified by Inspectors of Weights and Measures in accordance with the regulations made by the Ministry under the Cran Measures Act, 1908, since 1909, when the Act was put into operation, is as follows ;—

Year.	East Suffolk.	Yarmouth.	Grimsby.	Tynemouth.	Total.
1909	3,629	6,970	—	—	10,599
1910	4,945	2,314	3	—	7,262
1911	6,513	1,756	—	—	8,269
1912	5,900	2,773	—	—	8,673
1913	5,067	3,571	—	—	8,638
1914	4,357	2,753	—	2,124	9,234
1915	685	956	—	114	1,755
1916	850	1,307	—	620	2,777
1917	1,556	1,284	—	740	3,580
1918	1,494	1,269	—	1,243	4,006
1919	2,225	5,098	—	1,799	9,122
1920	5,086	10,806	4,105	2,545	22,542
1921	3,419	3,291	97	390	7,197
1922	2,801	1,042	—	200	4,043
1923	3,168	2,007	12	738	5,925
Total ...	51,695	47,197	4,217	10,513	111,622

No measures have been presented for verification in Cornwall, where the cran is very seldom used as a measure for herrings.

In the years 1919-23 the number of measures rejected by Inspectors of Weights and Measures in the various areas in which the Act is in operation is as follows:—

Year.	East Suffolk.	Yarmouth.	Grimsby.	Tynemouth.	Total.
1919	60	15	—	144	219
1920	104	1	20	46	171
1921	27	109	145	—	281
1922	528	120	—	114	762
1923	76	82	—	2	160
Total ...	795	327	165	306	1,593

It will be observed that a large number of baskets was marked at Grimsby during 1920. There was a very heavy demand for these baskets on account of the herring guarantee granted by the Government, and also on account of the good herring season, and the Grimsby basket manufacturers seized their opportunity, and took steps to meet the demand, that could not be adequately met in other quarters. The large numbers of baskets verified in 1920, together with the poor seasons of 1921 and 1922, no doubt contributed to the fall in the number of baskets verified in the latter years.

On 12 quarter-cran baskets the brand was obliterated at Yarmouth in 1919 on account of the baskets having become misshapen, and 52 measures previously marked were similarly treated in 1921. The brand was also obliterated on 7 measures at Tynemouth during 1920, and on 17 measures at Grimsby both in 1922 and in 1923.

The Tynemouth Town Council approached the Ministry in 1920 urging that the fee for the marking of a quarter-cran basket should be increased from ½d. to 1d. The administrative councils of the other four areas covered by the Cran Measures Act were asked for their observations on the proposal but no support was forthcoming and the suggestion was accordingly negatived.

A number of quarter-cran measures which had been branded in Scotland were brought into use at Great Yarmouth during 1923, and as the measures did not satisfy the requirements of the Ministry's regulations as to construction, the matter was reported by the Inspector of Weights and Measures to the Fishery Board for Scotland. It transpired later that the defects in these measures were attributable to the latitude in construction allowed to manufacturers some years ago when great difficulty was experienced in obtaining suitable materials.

FISHERY HARBOURS ACT, 1915.

The Fishery Harbours Act, 1915, enabled the Ministry to exercise in respect of a harbour principally used by the fishing industry certain powers of the Board of Trade under the General Pier and Harbour Act, 1861, and amending Acts, and to simplify the procedure for making Provisional Orders in respect of such harbours.

The power of making Orders under this Act was limited to a period of two years from the date the Act came into operation, except as regards the amendment of Orders already made under the Act. Its purpose was to provide cheaper and simpler machinery for setting up pier and harbour authorities for small fishing ports.

The power of making Orders accordingly lapsed in 1917 but was revived by the Fishery Harbours (Continuance of Powers) Act, 1917, and was continued by that Act to 31st December, 1918. Subsequently, this power was continued, by the Expiring Laws Continuance Acts, to 31st December, 1922, and was made permanent by the Expiring Laws Act, 1922.

Up to the end of 1923 three Provisional Orders were made under this Act, Orders having been confirmed in respect of Looe and Portloe during 1920, and Flamborough North Sea Landing in 1923.

PROCEEDINGS UNDER INTERNATIONAL CONVENTIONS, &c.

Disputes at Sea between British and Dutch Drift Net Fishermen.

The Ministry received information during the 1920 herring fishing season that there was some danger of serious disputes arising at sea between the driftermen of this country and of Holland.

One of the chief complaints of the British fishermen is that the Dutch driftermen carry a small anchor at the bow of their vessels in order to hook up the warp of any net which may be in danger of becoming entangled with their own. The hooking of another fisherman's warp is a violation of the North Sea Fisheries Convention, except in cases where both parties consent to the adoption of such a course, but the Netherlands fishermen contend that the practice of hanging a small anchor at the bows is calculated to minimise the risk of damage to nets by fouling and they are unwilling to relinquish what they regard as a precautionary measure.

In these circumstances arrangements were made for a small informal conference to be held between representatives of the Fishery Departments of England, Scotland and Holland, of the Board of Trade, and of the trade interests of the three countries, to discuss the best means of reducing the number of these disputes, the ultimate aim being the conclusion of an arrangement similar to the Anglo-Belgian Declaration of 1891.

The Conference was held in October, 1921, a representative of the French Government also being present.

The particular questions discussed were with regard to Article 15 of the North Sea Convention of 1882, which prohibits a vessel so shooting its nets as to interfere with those of vessels which have already commenced fishing operations, Articles 18, 20, 21, and 22, dealing with interference with the fishing gear of other vessels, and Articles 26, and 27, relating to legal proceedings.

With regard to Article 15, it was agreed unanimously that the Article was quite satisfactory as it stood and that no amendment was necessary or desirable.

There was a considerable divergence of opinion upon the question as to what should be done when the nets of different vessels came into contact. It was ultimately agreed that no amendment or alteration of the Convention was practicable.

The need for simplifying the machinery for recovering compensation for damage caused to gear, as between the Owners of vessels of different nationalities, was admitted on all sides and various proposals were put forward and discussed.

Ultimately it was decided that a standing International Court of Arbitration seemed likely to afford the best solution, and it was agreed that the representatives present should consult their respective Governments and the fishermen of their respective countries with a view to ascertaining their opinions as to a scheme upon these lines.

As a result of somewhat protracted negotiations, a draft scheme for international arbitration was drawn up by representatives of the Ministry and the Dutch fishermen and Government, and was submitted to the various Associations representing British Fisheries for their consideration.

Some difficulty was experienced in devising any satisfactory means by which the enforcement of the decisions of an International Court of Arbitration could be secured, and it appeared that the concensus of fishery opinion in this country was in favour of dealing with the questions involved by means of an international arrangement on the lines of the Anglo-Belgian Declaration of 1891 which has, in practice, proved on the whole satisfactory.

Steps are accordingly being taken with a view to framing such an international arrangement. It appears desirable, however, to make the new arrangement in certain respects an improvement on the Anglo-Belgian arrangement referred to above. In particular, it is proposed to make it clear that it is not necessary for the party responsible to be convicted of an offence under the Agreement before damages can be awarded to an injured party. It is also proposed that arrangements shall be made for the settling of small cases out of court.

Damage to Gear—Claims for Compensation.

Complaints of trouble arising between British and foreign fishing vessels are normally dealt with by the Board of Trade, and the following particulars are compiled from returns supplied to the Ministry by that Department.

During the year 1919, two claims were made by Lowestoft skippers against Dutch vessels for compensation for damage to nets, but no settlement could be arrived at and neither claim was pressed.

No claims were put forward during 1920.

In 1921, five claims were made against French trawlers and one against a Danish trawler by British vessels (three Brixham smacks, one Penzance boat, a Yarmouth drifter and a Milford Haven trawler). The three Brixham claims were settled out of court but for various reasons the other claims were not pressed. Six claims were also made by foreign vessels, three French, two Dutch and one Danish, against Grimsby, Milford Haven, London and Lowestoft trawlers or drifters. In no case has a settlement been reported.

In 1922, five complaints were made by British vessels (a Grimsby trawler against a German trawler and four Brixham smacks against French vessels) in respect of damage to gear. The identity of the German vessel could not be established. The remaining cases were settled privately. One complaint was made by a foreign vessel—a Frenchman against a Fleetwood trawler—the result of which is not yet known.

In 1923 there were seven claims by British vessels—two against French vessels, four against Icelandic vessels and one against a Dutch vessel. In the case of one of the French vessels the Board of Trade pointed out that the proper procedure was prosecution in the French courts, but the Ministry has not been informed as to what action, if any, was taken. In the second case, according to the information supplied to the Ministry, negotiations were proceeding for an amicable settlement out of court. The owners of the Dutch vessel were fined fl.75 and a rider was added to the verdict that the conviction would serve as a basis for a civil action for damages. The master of one of the Icelandic vessels when tried at Reykjavik, denied any knowledge of the incident. The case was dismissed, the damage being attributed to ice.

The three other cases against Icelandic vessels were referred by the Board of Trade to the Foreign Office for recovery of the damages claimed, but no particulars of any action taken have been received.

Two complaints were made by French vessels against London vessels and one case was tried at Milford Haven. The Frenchman was successful in proving his case and was awarded damages to the amount of £250. A fine of £15 was also imposed on the defendant. No information has been received as to whether any action has been taken in the second case.

Charges against Foreign Boats for Fishing within the Territorial Limits of England and Wales.

In the five years under review sixteen cases against French fishing vessels were tried in English courts. In all cases except one fines of either £5 or £10 were imposed with, in many cases, costs and confiscation either of gear and catch or of gear or catch alone. In the one exceptional case two offences were proved. For the first a fine of £7 10s. 0d., with £1 10s. 0d. costs, was imposed, and both catch and gear were confiscated; for the second a fine of £15.

Convictions of English Boats for Offences against the Fishery Laws of Foreign Countries.

Twenty-five convictions were recorded in the five years against British vessels, two being in respect of offences in the waters of Norway and the Faroe Islands respectively. In the majority of the cases the charge preferred was either that of fishing in Icelandic territorial waters or that of being in Icelandic waters without having fishing gear stowed away. The fines imposed varied from 100 kr. to 20,000 kr., and in certain cases in addition either catch alone or catch and gear were confiscated.

In 1920, the Icelandic Government passed a law under which minimum penalties were fixed at 10,000 kr., and confiscation of catch and gear for fishing within territorial limits, and 2,000 kr. for not having gear properly stowed when within territorial limits, and in this latter case, confiscation of catch and gear in the event of a second offence.

The captain of the trawler " Quercia," charged with fishing in Norwegian territorial waters, was fined 2,000 kr. and the owners 5,000 kr.

Conviction of Danish Fishing Skipper for Contravention of Article XIV of the North Sea Convention, 1882.

A prosecution of some interest to British fishermen as an instance of the practical value of the North Sea Convention of 1882 took place in the Danish courts in December, 1922.

A Danish fishing vessel had anchored on grounds normally used by drift net fishermen and, as a consequence, damage was done to a British drifter's nets, which fouled the Danish vessel's anchor cable. The defence urged on behalf of the skipper of the

Danish vessel, that the prohibition of anchoring between sunset and sunrise on grounds where fishing was actually going on did not include lying at anchor, was not upheld by the court. A fine of 100 kr., with costs, was imposed, and damages to the amount of £12 were awarded to the British drifter.

Close Season for Oyster-Dredging in Extra-Territorial Waters in the English Channel.

A British fishing smack was boarded by a French cruiser in May, 1922, while engaged in dredging for oysters in Caen Bay outside the French territorial limits, and was ordered to return to England. This action resulted from a lack of co-ordination between the British and French laws relating to the close time for oyster dredging outside territorial waters in the Channel. Representations were made by the Ministry to the French Fishery Authorities that instructions should be given to French cruisers not to enforce the French close season against British vessels fishing in extra-territorial waters, with the result that within a few days of the incident mentioned a telegram was received from the Director of Fisheries intimating that such instructions had been given, and the British smack was enabled to resume her dredging operations.

The close season was fixed by the Anglo-French Convention of 1839 as the period from 1st May to 31st August, and this Convention has never been abrogated, although the close season by English domestic law has been reduced to the period from the 16th June to the 31st August. The curious position therefore arose that from the French point of view it was illegal for an English vessel to take oysters in the area in question from 1st May to 15th June, although by English law it was not illegal to do so.

In order to obviate difficulties which might arise in these circumstances, it had been the practice of the two Governments to make arrangements annually to the effect that the fishery cruisers of each country would not interfere with vessels of the other country engaged in dredging for oysters outside territorial waters, but within the limits covered by the Convention of 1839, between 1st May and 15th June inclusive. In recent years, however, this annual arrangement had been allowed to lapse, and, with a view to adjusting the anomalous situation which had consequently arisen, and rendering unnecessary such temporary expedients, negotiations were commenced with the French Authorities for a permanent settlement on the lines of the British law, and, as a result, an agreement was signed on behalf of the French and British Governments to the effect that oyster fishing in the area in question shall open on 1st September and cease on 15th June. The agreement became operative on 1st October, 1923.

CHAPTER IX.—MISCELLANEOUS.

HARBOUR IMPROVEMENT.

During the war, as was only to be expected, the development of fishing ports came practically to a standstill, and the Armistice found fishermen at many small fishing ports round the coasts of England and Wales pursuing their calling under disadvantageous conditions, and often in circumstances which rendered the provision of new harbour accommodation, breakwaters, landing places, &c., imperative. Unfortunately, the state of the national finances since the war has not permitted the execution of many desirable improvements that in better times would have been regarded as essential for the well-being of the industry, and the Ministry has been compelled to advise the refusal of many applications for Government assistance towards the repair of old works or the construction of new ones.

A Committee known as the Small Harbours Committee, consisting of representatives of the Development Commission, the Ministry of Transport, the Fishery Departments for Scotland and Ireland, and the Ministry, was set up in 1919 to consider applications for grants, and from time to time meetings were held to discuss the various schemes for harbour improvement that had been put forward.

A summary of applications for assistance from Government funds in repairing old harbours or constructing new works, which have been put forward during the five years under review, is appended below.

Berwick.—Government assistance was asked for a scheme intended to relieve local unemployment by constructing a new harbour at the port. The work was estimated to cost £1,500,000, but in view of the financial stringency of the times, a scheme of this magnitude could not be considered, and a smaller alternative scheme was accordingly put forward, which if agreed to would have involved an estimated outlay of £300,000. The Ministry, however, was unable to approve the work proposed.

In 1922, the question of the improvement of the harbour again arose, and a further scheme of development was put forward involving the construction of a new pier and embankment, the extension of the front of the Fish Quay, and extensive dredging operations. This scheme was supported by the Town Council, who decided to impose an 8d. rate towards its cost, and an application, which the Ministry was asked to support, was made to the Trade Facilities Act Committee for a Government guarantee of a loan. The Ministry decided to take no action in this direction for the time being. Towards the end of the year, an application for an advance from the Development Fund towards the cost of the project was made by the Harbour Commissioners, and the Ministry was asked to report thereon. The Ministry considered the case in all its aspects, but in April, 1923, informed the Berwick Harbour Commissioners that the Department intended to refrain from reporting to the Development Commission on the application until such time as the Harbour Commissioners had reasonable prospects of being able to raise the bulk of the money required from local or other sources. The Harbour Commissioners also applied, at the request of the Treasury, for an Order under the Harbour Dock and Piers (Temporary Increase of Charges) Act, 1922, to enable an increase to be made in the harbour dues charged at the port. This was granted in August, 1923, and the Order permits the Harbour Commissioners to make an increase up to a maximum of 50 per cent. in their charges.

Bridlington.—The Harbour Commissioners applied for a grant of £15,000 from the Development Fund towards meeting the cost of proposed improvement works, but subsequently reduced the amount applied for to a minimum of £3,000 for dredging operations. The Ministry supported this application, and recommended it for favourable consideration to the Ministry of Transport with the reservation that before any monetary help should be granted, the Harbour Authority should be reconstituted under the Fishery Harbours Act, 1915. The Ministry of Transport, however, could not see its way to entertain the application.

Brixham.—The Brixham Urban District Council in September, 1921, made application to the Treasury for a grant of £500 from the Development Fund and a loan of an equal sum in aid of repairs to the breakwater, the cost of which was estimated not to exceed £1,000. Assistance from Government Funds had been granted before the war, but the work executed then had been endangered since by heavy gales and also by inability to carry out repair work during the war. The Development Commissioners acceded to the application on the recommendation of the Ministry, which supported it on the ground that the proposed work was essential for the preservation of the structure.

At the beginning of 1923 the Brixham Harbour Commissioners appealed to the Treasury for further financial assistance towards the maintenance of the harbour undertaking. The Treasury was also asked to grant permission for payment of instalments of loans granted by the Public Works Loan Board and the Development Commissioners to be suspended for a period of 15 years.

These requests have not been acceded to, and suggestions for increasing the revenue of the undertaking made as a result of an inquiry which was held at Brixham in May, 1923, have been conveyed to the Harbour Commissioners for their consideration. The suggestions made related to the rating of Lower Brixham in the interest of the harbour, the increase of dues and the issue of fish salesmen's licences.

It is understood that these matters are still under consideration by the Brixham authorities.

Flamborough.—The North Landing at Flamborough, up which the local fishermen had to haul their cobles with the assistance of a dilapidated steam engine, had through erosion become a very difficult landing place for boats, and proposals were put forward on behalf of the fishermen to remedy this serious inconvenience. Subsequently, however, the Clerk to the North Eastern Local Fisheries Committee discussed the question in conference with representatives of the Ministry, and of the Development Commission, and with Admiral Sir Guy Gaunt, M.P. As a result of this conference, the East Riding of Yorkshire County Council submitted to the Development Commissioners, on behalf of the Flamborough fishermen, an application for a grant of £2,500 in aid of the cost of works which had been suggested by engineers engaged to survey the landing.

The local fishermen promised, as their contribution, to provide a portion of the labour required for the construction of the work, and, as the scheme would provide, *inter alia*, for the protection of the lifeboat slipway at the North Landing, and the construction of another slipway which would be used by the lifeboat, the Royal National Lifeboat Institution was invited to make some contribution towards the cost of the projected improvements. The Royal National Lifeboat Institution ultimately made a grant of £300. The Ministry supported the application of the County Council, and subsequently the Treasury sanctioned a grant of a sum not exceeding £2,500 from the Development Fund. An Order was made under the Fishery Harbours Act, 1915, in respect of Flamborough North Sea Landing in September, 1923. The construction of the new landing slip has now been completed, and the total cost of the work was approximately £1,600.

Grimsby.—The Town Council approached the Unemployment Grants Committee for assistance in building a new dock. The docks are owned by the London and North Eastern Railway Company and it was estimated that the proposed work would cost £1,500,000, and would employ a large percentage of unskilled labour and take four years to complete. The Railway Company stated that they were not in a position to undertake the work without Government assistance. The scheme, as originally put forward, amounted practically to a request for a gift to the shareholders of the Company at the taxpayer's expense, and was not one which, in that form, could be seriously considered. The scheme was re-examined by the Town Council and Railway Company with a view to proposals being formulated that were free from such objections, and negotiations have been in progress since January, 1923, with a view to obtain from the Unemployment Grants Committee a grant of £200,000 towards the work. If this amount had been forthcoming, the London and North Eastern Railway Company would have been prepared to spend the sum of £1,050,000 on the scheme.

The Cabinet Committee on Unemployment, to whom the matter was finally referred, decided, however, that no grants could be made by the Unemployment Grants Committee to companies trading for profit.

Hope Cove.—The Ministry received an application from the Devon Local Fisheries Committee for a grant from the Development Fund in aid of the construction of a breakwater at Hope Cove. The local fishermen promised to contribute a sum of not less than £300 towards the cost of the proposed scheme, a large amount for a fishing community so small as that at Hope Cove. The Devon

Local Fisheries Committee also promised a contribution of £300, payable in three equal instalments spread over a period of three years, and agreed to make application for the constitution of a harbour authority under the Fishery Harbours Act, 1915.

The Ministry forwarded the application for a grant to the Development Commission, strongly recommending that an advance of a sum not exceeding £2,450 should be made in this case. It was suggested at the same time that £450 of this sum should be treated as a loan, and a sum not exceeding £2,000 as a free grant. The Commissioners acceded to this application.

King's Lynn.—The Town Council applied for Government assistance towards the cost of a harbour enlargement scheme, which had become necessary owing to the growth of the fishing fleet. Plans were submitted, but were not considered adequate, and the Town Council were asked to furnish fresh proposals. No further action has been taken.

Looe.—The Harbour Authority applied for a grant from Government funds of £3,500 in aid of expenditure already incurred or proposed to be incurred on the harbour works. The Ministry recommended that a sum of £3,000 should be granted, to be applied to repair work only, but the Ministry of Transport was obliged to postpone consideration of the application as it had no funds available.

Mousehole.—The Harbour Authority applied for a grant of £2,000 in aid of repairs to the South Pier, but the Small Harbours Committee could not support the application as the proximity of Newlyn rendered the improvement of Mousehole Harbour comparatively unimportant. In addition it was considered that the pier might well last until the time when repair work would become much less expensive. Subsequently, a crane used for moving baulks, forming when in position a boom defence for the protection of craft in the harbour, was destroyed in a gale, and the Harbour Commissioners applied to the Ministry for a grant or loan to replace it. The Ministry strongly supported this request to the Ministry of Transport, but it was refused owing to the lack of funds.

North Shields.—A scheme was put forward by the Tynemouth Corporation to the Ministry of Transport providing for the construction of a new dock and roadway at North Shields, but a grant was refused on financial and engineering grounds. Subsequently a deputation from the Corporation attended at the Ministry and presented proposals substantially the same as the previous ones, except that it was suggested that for the present the construction of a new road and sea wall only, at a cost of £45,000, should be considered. As a result, an application was made to the Treasury in October, 1921, for a grant from Development Funds. This application was referred to the Ministry of Transport, who, however, could not see its way to make a grant.

The Shields Engineering and Dry Dock Co., Ltd., also applied for assistance from the Unemployment Grants Committee in connection with a scheme for increasing the Company's docking facilities at a cost of £15,000, and the Ministry was requested to support the application, as it was contended that if the dry docking facilities were not increased the fishing industry would suffer. The Cabinet Committee on Unemployment, however, has decided that grants cannot be made to any company which is not a public utility company.

North Sunderland.—The condition of this harbour is bad, and the Trustees of Lord Crewe's Charity, who have in the past taken the responsibility for its maintenance, recently informed the Ministry that they were unable to undertake any further repair works owing to lack of funds. The Ministry does not, however, consider that there is justification for the recommendation of a grant to the Trustees for the improvement of this harbour.

Portloe.—In response to an application for financial help from the Government for the execution of harbour improvement works, the Development Commissioners promised a grant of £3,000 if a similar sum could be raised locally. Strenuous efforts were made to do so, but it was ultimately decided to postpone the scheme until the cost should become lower.

Rye.—The Town Council applied to the Ministry of Transport for assistance towards the restoration of the harbour to its pre-war condition. A survey of the harbour was made, and it was found that explosives would be effective in clearing the harbour of obstructions. As drainage interests were involved, interested authorities were advised to combine in order that a small committee might be formed to consider details and the drafting of a Provisional Order under the Land Drainage Act.

Scarborough.—An application for assistance first made in 1913 to enable harbour improvement to be effected at a cost of £150,000 was considered in 1921 by the Development Commissioners, who decided that further consideration of the proposal should be left over until a more favourable time.

St. Ives.—In March, 1919, the St. Ives Town Council applied to the Development Commissioners for an advance to improve the condition of the harbour. The proposed works were estimated to cost £90,000. Later in the year a further report was obtained and a scheme estimated to cost £60,000 was proposed. The Development Commissioners agreed to recommend an advance of this sum, half by way of grant and half as a loan. The offer was not accepted by the Town Council and consideration of a further scheme proposed by the latter was postponed by the Development Commissioners principally on account of high costs.

A proposal for dredging the harbour was also postponed pending a survey. At a later date the St. Ives Urban District Council applied for a grant from the Development Fund to meet the cost of the survey, and a grant of £155 was recommended by the Development Commission for the purpose.

Staithes.—An application has been made for a grant from the Development Fund in aid of the cost of constructing new harbour works at Staithes. The Treasury sanctioned a grant from the Development Fund of £10,000, and a sum not exceeding £2,130 as a loan, subject to contributions of £2,000 and £300 being forthcoming from the North Riding of Yorkshire County Council and local sources respectively. These sums have been promised, and the work has been put in hand. An Order under the Fishery Harbours Act, 1915, has been made in respect of Staithes.

Other Applications.—This Department was unable, in the cases of the following harbours, viz., Beer, Fleetwood, Freshwater (I.O.W.), Great Yarmouth, Hastings, Newbiggin, Newquay (Cardiganshire) and Whitby, to recommend that any assistance from Government funds should be given to the respective harbour authorities in order to enable them to effect improvements and/or repairs to their harbours.

A Departmental Committee, which was appointed to report on the question of fishery harbour development on the north-east coast, visited Filey in March, 1919. The Committee could not, however, recommend, in view of the need for economy in the expenditure of public money, that a harbour should be constructed at this place.

REPARATIONS.

Owing to the inability of Germany to make reparation on a ton for ton and class for class basis in respect of Allied shipping sunk during the war, by reason of the fact that the tonnage of German shipping in existence was much less than that lost by the Allies, it was provided in the Peace Treaty of Versailles that Germany should surrender to the Allies, *inter alia*, 25 per cent. of her trawler tonnage and 25 per cent. of other fishing tonnage.

The arrangements for the division amongst the various Allies of the tonnage to be surrendered were entrusted to the Reparation Commission, and in the course of further negotiations conducted by that Commission, the proposal was made by the Germans, and eventually accepted, that they should hand over a certain number of trawlers which had been examined and accepted by the representative of the Reparation Commission and that the rest of the tonnage due to be handed over should be built in Germany to the specifications of the Allies. Under the first part of this arrangement 24 trawlers were handed over to Great Britain as her share of the tonnage. A number of the vessels were in the first place berthed at Inverkeithing, Rosyth and Leith, but as accommodation could not be found for additional arrivals, all the boats were ultimately sent to Grimsby and were berthed at that port and at Immingham.

It soon became obvious that there was no demand from the fishing industry for these surrendered vessels and, accordingly, a further agreement was entered into with the Germans by which, on certain terms, other goods, *e.g.*, machinery of various kinds, fishing gear, motor engines, &c., produced in Germany, could be substituted for fishing tonnage. For various economic reasons no orders were placed under this arrangement, and ultimately the Reparation Commission was informed by the Fishery Departments that as far as the fishing industry was concerned it was desired that further reparation in kind should not be demanded from Germany.

At the end of 1920, the Reparation Commission made arrangements with Lord Inchcape for the sale of a number of the German trawlers lying at Grimsby and Immingham, and as a result twelve vessels were offered for sale by private treaty. The highest offer received for these vessels was too low to be accepted, and arrangements were then made to sell four boats by public auction in January, 1921. These vessels were, however, withdrawn as the reserve price was not reached.

Ultimately, two trawlers were sold by Lord Inchcape for £8,000 each, and at a later date, when values for all fishing vessels had reached a very low level and maintenance charges were correspondingly high, the remaining 22 boats were sold for £50,000.

The demands made upon Germany in respect of trawler tonnage for the purpose of replacing to some extent the loss of British fishing vessels through enemy action during the war constituted, of course, only a small item in the general reparation demand, and the question of compensating people who had suffered loss or injury as a result of enemy action was one that received careful consideration on the part of the Government.

Buoyage of Wrecks.

One consequence of the war was the scattering round the coasts of this country of an enormous number of wrecks which greatly hampered the fishing industry in its operations. The majority of the wrecks are unmarked and, therefore, difficult to avoid. Consequently, a considerable amount of fishing gear has been damaged or lost by contact with wrecks and, owing to the high cost of such gear, the question has become one of importance to the industry. The efforts of the Ministry to help the industry in this matter have been, for the reasons given below, largely unsuccessful, except in a few cases where it has succeeded in inducing the authorities concerned to remove wrecks on the ground that they interfered with the navigation of fishing and other vessels.

The dispersal of the wrecks by explosion has been suggested on many occasions, but a very serious objection to this proposal is the fact that such dispersals would tend to increase the area over which the obstructions are spread. Equally cogent reasons can be advanced against another suggestion, viz., that the position of all wrecks should be marked by means of buoys; the expense incurred in buoying the large number of wrecks round the coast would be prohibitive, and, moreover, the existence of such a large number of buoys would cause great confusion to sea traffic, as well as obstruct the operations of drift-net fishermen. A third suggestion has been to raise the sunken vessels. This proposal would, no doubt, be effective in some cases, but in others quite impracticable. In any case financial considerations would render its adoption impossible.

It has also been suggested to the Ministry that it would, in some small degree, benefit the fishing industry if a few of the more important wrecks could be buoyed so as to enable the fishermen, by using the wreck charts which have been issued by the Admiralty, to keep clear of the majority of these obstructions. Unfortunately, the provision of the necessary funds for the maintenance of the buoys has hitherto proved an insuperable obstacle to an otherwise quite feasible and practical proposal. Moreover, the case for buoying even a few of the wrecks is, from the fishermen's point of view, weakened by the fact that they do not pay light dues and have no real claim to have navigation marks provided at the public expense for their sole benefit.

OIL POLLUTION.

Owing to the fact that during the last few years there has been a great increase in the number of vessels using oil fuel, the question of the pollution of the sea by oil has become one of some importance and very careful consideration has been given to this matter by the various Government Departments concerned with a view to reducing pollution of this nature to a minimum.

The principal causes of oil pollution are leakages from oil carrying vessels, the cleaning of oil bunkers and losses of oil which occur when transfers are made from vessel to vessel or from storage tank to vessel or *vice versâ.* In addition some pollution has been undoubtedly due to the breaking up of vessels sunk during the war.

Although in some localities the effects of the pollution of the sea by oil are minimised, and in course of time eliminated by wind and wave action, it frequently happens that, as pollution usually occurs in harbours and in other places where either by natural or artificial means the unrestricted movement of the water is prevented, unpleasant and at times injurious results are produced. Among the latter may be mentioned the sufferings of gulls, guillemots and other sea birds which are rendered quite helpless by the clogging of their feathers with oil.

Legislative action to deal with the question was taken by the Board of Trade, with the result that on 1st January, 1923, there came into operation the "Oil in Navigable Waters Act, 1922," which had been drafted in consultation with the Ministry. This Act imposes a heavy penalty upon persons who allow oil to be discharged into the territorial waters and harbours of this country, and prohibits the transfer of oil at night except under certain conditions.

The Ministry issued on 20th February, 1923, General Directions (Statutory Rules and Orders, 1923, No. 229) under Section 7 (4) of the Act, authorising the institution of proceedings by any Local Fisheries Committee constituted under the Sea Fisheries Regulation Act, 1888, or by any Board of Conservators constituted under the Salmon and Freshwater Fisheries Acts, 1861 to 1921, or any of those Acts, for an offence under the Oil in Navigable Waters Act committed within the district of the Committee or Board. This authority does not apply to any offence committed by any Sanitary Authority or Joint Board, nor to offences committed within harbours under the jurisdiction of a Harbour Board.

The Local Fisheries Committees and Boards of Conservators were also invited to nominate persons whom it was desired that the Minister should authorise under Section 3 (3) of the Act to inspect the records of transfers of oil to and from vessels which the Act required should be kept. Only a few Committees and Boards desired to avail themselves of this invitation, and thirteen instruments of authorisation only have been issued. All the Ministry's Fishery Officers have, however, been authorised to inspect these records, and general instructions regarding the action to be taken in cases where oil pollution occurs have also been given to these Officers.

The Admiralty also gave the matter special attention in view of the large number of oil-burning ships under their control and the possibility of leakage from Naval oil stores and H.M. Ships in the Thames Estuary. As a result of the report of a Committee appointed by the Commander-in-Chief at the Nore to consider the question, the Naval Authorities have taken all practicable steps to prevent any trouble arising from the leakage of oil from Admiralty vessels or stores.

The aspect of the matter which most closely concerned the Ministry was the effect of the pollution on fisheries generally and in particular on shell-fish. However, the scientific investigations which have been conducted by the Department into this question do not indicate that oil is actually injurious to fish life of any kind, although the presence of oil on the shells of molluscs would naturally detract considerably from their market value. Meanwhile further investigations are in progress.

It is understood that the United States are collating information regarding the oil nuisance, and it is possible that ultimately an international agreement may be arranged making it illegal for vessels to discharge, or allow to escape, oil, except into proper receptacles.

THE USE OF AEROPLANES FOR SPOTTING SHOALS OF HERRING.

In October, 1921, three flights were made by a seaplane from the Felixstowe Station of the Royal Air Force, carrying a member of the Ministry's scientific staff as observer, in order to test the possibility of discovering shoals of herring by aerial observation. The first flight was undertaken under conditions of poor visibility, the second had to be abandoned owing to the machine running into thick banks of fog and then into rain, while the third was made under singularly good conditions: the flights were supplemented by observations made from a drifter.

The general results of the observations appear to be fatal to any expectation that seaplanes can be used for determining the position of herring shoals for fishery purposes in the area in question, at any rate during the autumn season. Not only is the visibility in the southern part of the North Sea at this time of the year seldom favourable for observation, but practically all the waters in which herring are found between the Humber and the Straits of Dover are thick with sand and other matter in suspension. These factors caused great difficulties to flying officers when searching for submarines and submerged mines during the war.

These conditions are not necessarily present in other areas and at other seasons, and the negative results of the tests described above did not appear to affect the possibilities of success under different conditions. Indeed, a flying officer who had made a great many flights off the coasts of Cornwall and Devon stated that he frequently observed shoals of mackerel and pilchards when over the clear waters of that coast, but that, on the contrary, he had never detected fish in the southern part of the North Sea.

Arrangements were therefore made to continue the experiments under different conditions, and a second series of flights was undertaken covering the principal areas of the mackerel fishery in the Western Channel when that fishery was in full swing—in March, 1923. Only two flights were possible, the first, of 3¼ hours' duration, covering the area between Plymouth and the Scilly Isles. Observations regarding fish were entirely negative although landings from vessels fishing at the time were exceptionally heavy. This may be accounted for by the facts that the water was not clear, probably owing to recent storms, so that even close inshore it was impossible to see the bottom, and that the surface of the sea was rough and blown into numerous white streaks making observation through the surface almost impossible, and also, probably, presenting conditions unfavourable for the surface swimming of fish. As in the case of the North Sea flights, shadows cast by numerous small clouds also added to the difficulties. On the second occasion, although the sea was less rough, observational conditions were found to be similar and, as visibility was becoming poorer, it was judged useless to make an extended flight. No further opportunities for flights occurred.

Although no exhaustive tests were possible it seems reasonable to conclude, taking into consideration the prevailing weather conditions and the fact that clear water is only obtained after some days of calm weather, that for the waters around England aerial spotting of shoals of fish is likely to be possible only from May to September in areas of deep, clear water, and its practical value remains yet to be demonstrated.

A full report on these flights has been published.*

A point which must be borne in mind in connection with these experiments is that an airship or slower moving aeroplane would be a much more suitable craft to employ for observations of this nature than the machine actually used. It appears from a French report† that in observations made from an airship it was possible to distinguish shoals of sprats from sardines, while observations from aeroplanes were generally without results.

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* *Report on the Possibilities of Aerial Spotting of Fish*, by A. C. Hardy, M.A.—Fishery Investigations, Series II, Vol. VII, No. 5, 1924. Price 1s. net.

† *La Co-opération de la Navigation aérienne aux Pêches Maritimes*, by H. Heldt.—Notes et Mémoires No. 12 of the Office Scientifique et Technique des Pêches Maritimes, Paris.

The Disposal of Surplus Ammunition.

One of the minor duties which fell to the Ministry on the cessation of hostilities related to the disposal of surplus munitions. Early in 1919 the depots in various parts of the country where ammunition had been stored during the war quickly became congested as a result of the stoppage of deliveries to the various theatres of war, and the question of the satisfactory disposal of this material soon became a matter of urgency.

The War Departments were very naturally anxious to get rid of this ammunition in the speediest and most economical manner possible. Its destruction on land was impracticable owing to the expense involved and the danger to human life, and the manner of disposal selected for many types of ammunition was that of dumping in the sea. The Ministry, however, was equally anxious that, if it were to be dumped at sea, dumping should not take place at sites where there was any risk of injury to fishery interests. The danger from the fisheries standpoint was twofold. In the first place there was the possibility of trawlers bringing up boxes of explosives or liquid gas which might endanger the ship or crew; in the second place, some apprehension was felt lest the gases released from the dumped material (particularly gas shells and gas drums) might render the water in the neighbourhood uninhabitable to fish life or else render the fish unmarketable.

This twofold danger of indiscriminate dumping was brought home to the Ministry at a very early stage when numerous complaints were received from shrimp fishermen of the Thames Estuary of damage caused to nets through trawling up boxes of Naval munitions. It was also complained that the shrimps caught, while perhaps not actually poisonous, were unpalatable and consequently unmarketable.

Arrangements were accordingly made with the Departments concerned for the Ministry to be consulted as to suitable dumping grounds for the various lots of ammunition as they came up for disposal, and one of the chief sites selected, principally for the dumping of T.N.T., was the Black Deep in the Thames Estuary. The Black Deep was selected because there was practically no fishing carried out there, the site being used as a "spoil ground" for London's sludge. In 1920, there occurred a serious mortality among oysters, commencing in the River Blackwater and spreading to all the beds of the Thames Estuary, and it was not surprising that the oyster growers attributed the mortality to the effect of the dumping of T.N.T. in the Black Deep. Dumping in the area was immediately stopped, pending the result of the investigations referred to in Chapter VII, and the Ministry pressed for the abolition of all dumping at a depth less than 200 fathoms. As, however, this would have involved the use of ocean-going steamers for dumping and would consequently have increased the cost to a prohibitive amount, the Ministry's proposal was not accepted. In the circumstances, therefore, the Ministry was compelled to content itself with insisting that dumping should only be carried out at certain specified points accessible to hopper barges.

In the meantime, certain interim results of the investigations referred to above showed that, although the causes of the mortality were still unknown, it was not possible to ascribe it to the dumping of ammunition and, after a meeting with the representatives of the oyster industry, dumping, on a limited scale and subject to certain conditions, was recommenced in the Black Deep. Arrangements were, nevertheless, made for the dumping of small quantities of certain specially dangerous forms of munitions beyond the 200 fathom line. For the remainder, arrangements were made between the Ministry and the Disposals Board for dumping to be carried out in certain areas where, owing to the condition of the sea bed (*e.g.*, rocks, wrecks, &c.), the risk of damage to fishermen or fisheries was extremely remote. There were three main sites, (1) along a line between the Skerries and the Calf of Man (10 miles from shore), (2) a deep pit in the Hurd Deep in the English Channel, and (3) the Helwick Sands in the Bristol Channel. In addition, special sites were agreed between the Ministry and the War Departments from time to time for the dumping of small quantities of material the transport of which for a long distance might, from one cause or another, increase the risk of accident.

FISH DELIVERED AND CONDEMNED AT BILLINGSGATE.

The Ministry is indebted to the Fishmongers' Company for continuing to furnish it with monthly statements showing the quantity of fish condemned at Billingsgate as being unfit for food, in comparison with the total quantity delivered at and near the market. The particulars for the eleven years 1913 to 1923 are summarised as follows :—

Year.	Total Quantity Delivered.		Quantity Condemned.				Percentage Condemned.		
			Wet Fish.		Shell Fish.		All Fish.		
	By land.	By water.*	Delivered by land.	Delivered by water.	Delivered by land.	Delivered by water.	Delivered by land.	Delivered by water.	Total.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Per cent.	Per cent.	Per cent.
1913	3,201,060	1,233.560	7,335	10,695	3,166	3,8 3	0·33	1·18	0·56
1914	3,307,580	872,880	11,619	7,319	3,810	4,250	0·47	1·33	0·65
1915	2,500.644	348,832	8,697	1,965	5,327	4,057	0·56	1·73	0·70
1916	2,277,506	98,069	12,103	2,722	5,787	3,653	0·79	6·50	1·02
1917.	2,151,035	72,469	13,206	15,889	5,631	287	0·88	22·32	1·57
1918	2,425,282	3,068	39,449	4	3,832	32	1·78	1·17	1·78
1919	3,166.510	187,210	52.690	3,006	3,864	2,036	1·79	2·69	1·84
1920	4,738,408	392,858	45,007	2,288	5,558	1,536	1·07	0·97	1·06
1921	3,976,858	573,208	35,851	5,045	5,730	4,980	1·05	1·75	1·13
1922	4,218,274	629,413	29,670	7,413	4,786	3,320	0·82	1·71	0·93
1923	4,234,726	549,572	28,984	3,479	5,322	2,438	0·81	1·08	0·84

The following tables taken from the monthly statements of the Fishmongers' Company may be of interest to show how the fish trade contrived to keep London supplied with fish during the railway strike in September and October of 1919 and the coal strike in approximately the same period of 1920.

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* Including landings by foreign vessels.

Weight of fish delivered at or near Billingsgate during the period August-November, 1919 :—

Month.	By Land. Chiefly by Rail.	By Water.	Total.
	Cwts.	Cwts.	Cwts.
August	305,030	14,095	319,125
September ...	291,535	30,140	321,675
October	187,200	68,860	256,060
November ...	375,933	19,948	395,881

Weight of fish delivered at or near Billingsgate during the period August-November, 1920.

Month.	By Land.	By Water.	Total.
	Cwts.	Cwts.	Cwts.
August	380,241	41,800	422,041
September ...	375,328	41,140	416,468
October	406,176	42,180	448,356
November ...	401,442	30,520	431,962

It will be observed that, although the fishing fleets were only allowed 50 per cent. of their normal consumption of coal during the strike period of 1920, practically no difference was made in the quantities of fish brought to the market, only the normal fluctuations being noticeable.

During the railway strike of 1919, a substantial decrease in the quantity of fish brought to the market by land in October, in which month the greater portion of the strike period occurred, is to be noticed, while over three times the normal amount was brought by water.

The hope that a return to more stable conditions would result in a decrease of the percentage of fish condemned, was not, so far as the year 1919 is concerned, justified; in fact, the steady increase in these figures, which was a feature of the war period, continued during that year. A marked decrease is, however, noticeable in the figures for 1920. In the case of rail-borne fish, this improvement was maintained in 1921, in spite of the long hot summer, and, although the figures for water-borne fish are less satisfactory, the percentage condemned of the total quantity delivered was little higher in 1921 than in the previous year. There is, however, plenty of room for improvement in this respect before pre-war conditions are again reached, for, although the figures for 1922 and 1923 show a distinct improvement this was doubtless owing to the cooler weather of those years.

APPENDIX A.

List of Sea Fisheries Districts created, and of Boards of Conservators and Harbour Authorities on whom the Powers of a Local Fisheries Committee have been conferred, by Orders in force on 31st March, 1924.

Names and Limits of Districts.	Boards of Conservators and Harbour Authorities.	Chairmen.	Clerks.
Cumberland (*Sark Foot to Haverigg Point*).	... .	William Lewthwaite, Broadgate, Broughton-in-Furness.	C. W. Allan Hodgson, County Offices, Carlisle.
	Eden	N. Fletcher, Eden Brows, Armathwaite, Cumberland.	F. W. Soal, 38, Lowther Street, Carlisle, Cumberland.
	Derwent ...	Rev. Canon Sutton, Bridekirk Vicarage, near Cockermouth, Cumberland.	Thomas Rook, Court Buildings, Cockermouth, Cumberland.
	West Cumberland		W. H. Chapman, 42, Lowther Street, Whitehaven, Cumberland.
Lancashire and Western (*Haverigg Point to Cemmaes Head*).	... ...	Sir Charles MacIver, Glan-y-menai, Menai Bridge, Anglesey.	J. P. Muspratt, County Offices, Preston.
	Kent and Bela ...	R. J. Clegg, Dick Intake, Windermere.	Hart Jackson and Son, Ulverston, Lancs.
	Lune	Edmund Sharpe, Halton Hall, nr. Lancaster.	J. T. Sanderson, 67, Church Street, Lancaster.
	Ribble	R. A. Tatton, Cuerden Hall, Preston.	Thos. Reveley, 15, Winckley Street, Preston.
	Dee	Sir H. B. Robertson, Pale, Corwen, Merionethshire.	Henry Jolliffe, 13, St. John Street, Chester.
	Elwy and Clwyd	W. G. Rigby, Pentre Mawr, Denbigh.	F. W. Grimsley, Bryn Gobaith, St. Asaph, Flintshire.
	Conway	Maj. A. E. Priddle, Plas Madoc, Llanrwst.	C. T. Allard, Station Road, Llanrwst, Denbighshire.
	Seiont	J. E. Greaves, J.P., C.B.E., Glangwna, Carnarvon.	Richard Roberts, Palace Chambers, Carnarvon.
	Dwyfach ...	T. J. Houghton-Davies, Pwllheli.	David Jones, 1, Bank Place, Portmadoc.

Names and Limits of Districts.	Boards of Conservators and Harbour Authorities.	Chairmen.	Clerks
Lancashire and Western—*cont.*	Dovey	Maj. H. M. Richards, O.B.E., Caerynwch, Dolgelly, N. Wales.	J. Jones Williams Dolgelly, N. Wales.
	Ayron	G. S. Briggs, Monachty, Cilian Aeron, Aberayron.	R. C. Evans, 1, Alban Sq., Aberayron, Cardiganshire.
	Teify	Col. E. C. L. Fitzwilliams, C.M.G. Brynteify, Pentrecourt, Llandyssul.	James Angus, Ponttwelly, Llandyssul.
South Wales (*Cemmaes Head to a line drawn through Flatholm.*)	... ...	C. H. Vickerman. St. Issels House, Saundersfoot, Pembrokeshire.	A. H. Deer, Courtland Chambers, Port Talbot.
	Cleddy	J. C. Yorke, Langton, Dwrbach, S.O., Pembrokeshire.	R. T. P. Williams, 12, High Street, Haverfordwest.
	Towy	Sir Mervyn Ll. Peel, Danyrallt, Llangadock.	C. H. Morgan Griffiths, St. Mary Street, Carmarthen.
	Ogmore... ...	J. I. D. Nicholl. Merthyr Mawr House, Bridgend.	S. H. Stockwood Bridgend, Glam.
	Taff and Ely ...	Col. Henry Lewis, Greenmeadow, Tongwynlais, Cardiff.	Arthur Waldron, 17, Church Street, Cardiff.
	Rhymney ...	L. Forestier-Walker, M.P., Park House, Rhiwderin, Newport, Mon.	Horace S. Lyne, Westgate Chambers, Newport, Mon.
	Usk	W. R. Herbert-Huddlestone, Clytha, near Abergavenny, Mon.	Horace S. Lyne, Westgate Chambers, Newport, Mon.
	Wye	J. A. Hutton, Woodlands, Alderley Edge, Cheshire.	Major F. A. Phillips, D.S.O., 46 Commercial Street, Hereford.
	Severn	J. W. Willis Bund, Wick Episcopi, Worcester.	J. Stallard, 3, Pierpoint Street Worcester.
Cornwall (*Northern boundary of Cornwall to Rame Head*).	... ...	Howard Dunn, Honeycombe, Mevagissey.	W. L. Platts, County Hall, Truro.
	Camel	Vice-Admiral Sir A. W. May, K.C.B., Tremeer, St. Tudy, S.O. Cornwall.	Owen Clayton, Wadebridge, Cornwall.
	Fowey		Robt. Pease, Lostwithiel, Cornwall.

Names and Limits of Districts.	Boards of Conservators and Harbour Authorities.	Chairmen.	Clerks.
Devon (Northern Section : *Eastern boundary to Western boundary of Devon;* Southern Section : *Rame Head to Eastern boundary of Devon*).	... ...	E. C. Perry, 34, Pennsylvania Road, Exeter.	H. Ford, 25, Southernhay, Exeter, Devon.
	Taw and Torridge	J. M. Pope, Coplestone House Copplestone, Devon.	R. E. C. Balsdon, 109, Boutport St., Barnstaple, N. Devon.
	Tamar and Plym	Capt. R. C. Coode, Polapit, Tamar, Launceston.	W. W. Mathews, Tavistock, Devon.
	Avon (Devon) ...	Major G. M. Conran, D.L., Bradridge House, South Brent, Devon.	W. Beer, Kingsbridge, Devon.
	Dart	Chas. Barran, Berry House, Totnes.	G. E. Windeatt, 19, High Street, Totnes, Devon.
	Teign	Hon. Chas. Clifford, Ugbrooke, Chudleigh, Devon.	H. G. Michelmore, Market Street, Newton Abbot.
	Exe	Chas. Collier, Bridge House, Culmstock, Cullompton.	H. Ford, 25, Southernhay, Exeter, Devon.
	Otter	— –	——
Southern (*Western boundary of Dorset to Hayling Island*).	... ...	A. Hemingway, 153, Queen's Road, Buckland, Portsmouth.	H. Tattersall, LL.B., 108, Old Christchurch Road, Bournemouth.
	Axe	F. Roper, Forde Abbey, Chard, Somerset.	W. G. Forward, Axminster, Devon.
	Frome	G. D. Bond, Holme, Wareham, Dorset.	F. Bollam, North Street, Wareham, Dorset.
	Hampshire Rivers	Maj. John D. Mills, J.P., Bisterne, Ringwood, Hants.	C. J. Haydon, Westover Chambers, Bournemouth, Hants.
	Southampton Harbour Board	H. Parsons, J.P., Town Quay, Southampton.	W. G. Gubbins, Town Quay, Southampton.
Sussex (*Hayling Island to Dungeness*).	... .	H. T. Dighton, "Allandale," St. Helens Crescent, Hastings.	C. L. Whiteman, County Hall, Chichester.
Kent and Essex (*Dungeness to Dovercourt*).	... .	S. Brown, Westfields, Whitstable, Kent.	H. W. Gibson, River Plate House, Finsbury Circus, London, E.C.
	Stour (Kent) ...	——	——
	Town Council of Colchester	The Mayor, Colchester.	H. C. Wanklyn, Town Hall, Colchester.

Names and Limits of Districts	Boards of Conservators and Harbour Authorities.	Chairmen.	Clerks.
Kent and Essex—*cont.*	Suffolk and Essex	The Rt. Hon. E. G. Pretyman, Orwell Park, Ipswich, Suffolk.	A. T. Cobbold, County Hall, Ipswich, Suffolk.
Eastern (*Southern boundary of Norfolk to Donna Nook Beacon*).	... ...	Albert E. H. Birch, Watlington Hall, Norfolk.	W. D. Ward, Tuesday Market Place, King's Lynn.
North - Eastern (*Donna Nook Beacon to River Tyne*).	... ...	W. Hakes, Commercial Road, Hull.	J. R. Procter, County Hall, Beverley.
	Trent	H. Anson-Horton, Catton Hall, Burton - on - Trent.	G. R. Eddowes, 34, Irongate, Derby.
	Yorkshire ...		W. E. Puckering, National Provincial Bank Chambers, York.
	Esk (Yorkshire) .	J. K. Foster, J.P., Egton Manor, Egton Bridge, Yorks.	C. E. Brown, 4, Flowergate, Whitby, Yorks.
	Tees	The Rt. Hon. Lord Gainford, Headlam Hall, Darlington.	A. W. Smith, C.B.E., 6, Church Row, Darlington, Co. Durham.
	Wear	Col. T. C. McKenzie, The Cedars, Sunderland, Co. Durham.	Wm. E. Raine, 48, Frederick Street, Sunderland, Co. Durham.
Northumberland (*the River Tyne to the boundary between England and Scotland*).	... ...	D. H. W. Askew, Castle Hills, Berwick-on-Tweed.	G. E. Wilkinson, 1, Mosley Street, Newcastle - on - Tyne.
	Tyne	Thos. Taylor, Chipchase Castle, Wark, Northumberland.	J. Arnott Williamson, Prudential Buildings, Mosley Street, Newcastle-on-Tyne.
	Coquet	C. E. Young, Dacre Croft, Morpeth.	H. J. Percy, S, Bondgate Within, Alnwick.

APPENDIX B.

ABSTRACT OF ACCOUNTS OF THE SEVERAL LOCAL FISHERIES COMMITTEES.

(*a*) For the Year ending 31st March, 1919.

District.	Balance in hand 1st April, 1918. 1	Contributions of Councils charged with Expenses. 2	Miscellaneous Receipts. 3	Total Receipts. 4	Deficit 31st Mar., 1919. 5	Deficit 1st April, 1918. 6	Salaries.		Travelling Expenses of Fishery Officers. 9	Cost of Prosecutions and Law Expenses generally. 10	Purchase, Maintenance or Hire of Vessels or Boats. 11	Stationery, Printing, Postage and Advertisements. 12	Miscellaneous Expenditure. 13	Total Expenditure. 14	Balance in hand 31st March, 1919. 15
							Clerk, &c. 7	Fishery Officers. 8							
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Cumberland	153	700	646	1,346	—	—	—	702	61	—	517	18	116	1,414	85
Lancashire and Western ...	775	5,338	1,693	7,031	—		1,075	1,385	338	15	470	228	2,233	5,744	2,062
South Wales	97	300	2	302	—	—	100	130	37	—	—	50	—	317	82
Cornwall	152	150	6	156	—	—	—	130	60	—	—	12	17	219	89
Devon	19	432	—	432	—	—	75	134	74	40	50	63	—	436	15
Southern	114	280	—	280	—	—	90	50	48	—	—	22	22	232	162
Sussex	124	380	—	380	—	—	26	241	108	—	—	27	1	403	101
Kent and Essex	109	200	—	200	—	—	85	68	3	—	—	31	8	195	114
Eastern	48	4,678	128	4,806	—	—	220	2,036	91	—	2,387	55	37	4,826	28
North-Eastern	2,265	900	76	976	—		160	499	201	—	—	36	67	963	2,278
Northumberland	408	400	4	404	—	—	100	206	100	6	—	63	2	177	335
Total	4,264	13,758	2,555	16,313	—	—	1,931	5,581	1,121	61	3,424	605	2,503	15,226	5,351

(*b*) For the Year ending 31st March, 1920.

District.	Balance in hand 1st April, 1919. 1	Contributions of Councils charged with Expenses. 2	Miscellaneous Receipts. 3	Total Receipts. 4	Deficit 31st Mar., 1920. 5	Deficit 1st April, 1919. 6	Salaries.		Travelling Expenses of Fishery Officers. 9	Cost of Prosecutions and Law Expenses generally. 10	Purchase, Maintenance or Hire of Vessels or Boats. 11	Stationery, Printing, Postage and Advertisements. 12	Miscellaneous Expenditure. 13	Total Expenditure. 14	Balance in hand 31st March, 1920. 15
							Clerk, &c. 7	Fishery Officers. 8							
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Cumberland	85	1,150	378	1,528	—		—	791	56	1	635	12	42	1,537	76
Lancashire and Western ...	2,062	8,857	5.490	14,347	—	—	1,261	4,462	359	45	5,689	—	2,978	14,794	1,615
South Wales	82	300	1	301	—	—	100	130	8	—	—	30	27	295	88
Cornwall	89	250	5	255	—	—	—	160	60	—	—	30	33	283	61
Devon	15	432	27	459	—	—	100	144	75	8	39	66	20	452	22
Southern	162	560	—	560	—	—	90	315	71	—	—	41	45	562	160
Sussex	101	456	—	456	—	—	28	273	112	—	—	38	1	452	105
Kent and Essex	114	200	—	200	—	—	85	79	8	—	—	51	11	234	80
Eastern	28	6,200	1,210	7,410	—	—	220	2,688	100	12	3,100	131	583	6,834	604
North-Eastern	2,278	1.240	90	1,330	—	—	160	990	306	—	—	72	163	1,691	1,917
Northumberland	335	500	6	506	—	—	96	329	130	—	—	44	36	635	206
Total	5,351	20.145	7,207	27,352	—	—	2,140	10,361	1,285	66	9,463	515	3,939	27,769	4,934

(*c*) For the Year ending 31st March, 1921.

District.	Balance in hand 1st April, 1920. 1	Contributions of Councils charged with Expenses. 2	Miscellaneous Receipts. 3	Total Receipts. 4	Deficit 31st Mar., 1921. 5	Deficit 1st April, 1920. 6	Salaries. Clerk, &c. 7	Salaries. Fishery Officers. 8	Travelling Expenses of Fishery Officers. 9	Cost of Prosecutions and Law Expenses generally. 10	Purchase, Maintenance or Hire of Vessels or Boats 11	Stationery, Printing, Postage and Advertisements. 12	Miscellaneous Expenditure. 13	Total Expenditure. 14	Balance in hand 31st March, 1921 15
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Cumberland	76	800	2,148	2,948	—	—	—	567	75	2	305	24	128	1,101	1,923
Lancashire and Western ...	1,615	8,903	2,643	11,546	—	—	1,635	4,913	479	39	3,009	336	2,284	12,695	466
South Wales	88	756	5	761	—	—	100	443	92	—	—	96	19	750	99
Cornwall	61	350	6	356	—	—	—	160	81	—	—	21	36	298	119
Devon	22	540	5	545	—	—	100	151	84	24	66	72	11	508	59
Southern	160	560	—	560	—	—	90	320	80	—	—	45	52	587	133
Sussex	105	551	—	551	—	—	37	330	130	—	—	58	—	555	101
Kent and Essex	80	300	—	300	—	—	120	69	10	—	—	65	16	280	100
Eastern	604	6,920	476	7,396	—	—	235	3,543	111	13	2,584	114	204	6,804	1,196
North-Eastern	1,917	2,800	82	2,882	—	—	235	1,351	417	3	—	80	227	2,313	2,486
Northumberland	206	1,050	83	1,133	—	—	100	396	166	—	65	57	202	986	353
Total	4,934	23,530	5,448	28.978	—	—	2,652	12,243	1,725	81	6,029	968	3,179	26,877	7,035

(*d*) For the Year ending 31st March, 1922.

District.	Balance in hand 1st April, 1921. 1	Contributions of Councils charged with Expenses. 2	Miscellaneous Receipts. 3	Total Receipts. 4	Deficit 31st Mar., 1922. 5	Deficit 1st April, 1921. 6	Salaries.		Travelling Expenses of Fishery Officers. 9	Cost of Prosecutions and Law Expenses generally. 10	Purchase, Maintenance or Hire of Vessels or Boats. 11	Stationery, Printing, Postage and Advertisements. 12	Miscellaneous Expenditure. 13	Total Expenditure. 14	Balance in hand 31st March, 1922. 15
							Clerk, &c. 7	Fishery Officers. 8							
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Cumberland	1,923	450	1,911	2,361	—	—	—	286	66	7	48	9	3,787	4,203	81
Lancashire and Western	466	9,321	3,252	12,573	—	—	125	4,948	264	53	3,286	328	3,664	12,668	371
South Wales	445	894	5	899	—	—	100	413	199	—	—	121	28	861	483
Cornwall	119	380	9	389	—	—	—	160	88	—	—	25	15	288	220
Devon	59	540	6	546	—	—	100	151	87	64	90	76	18	586	19
Southern	133	560	—	560	—	—	130	322	86	—	—	50	54	642	51
Sussex	101	570	—	570	—	—	40	338	135	—	—	73	—	586	85
Kent and Essex	100	300	5	305	—	—	120	69	8	19	—	70	19	305	100
Eastern	1,196	6,850	66	6,916	—	—	250	3,761	104	35	2,426	91	75	6,742	1,370
North-Eastern	2,486	2,900	94	2,994	—	—	220	1,309	425	—	—	56	129	2,139	3,341
Northumberland	353	950	2	952	—	—	100	387	171	48	112	73	188	1,079	226
Total	7,381	23,715	5,350	29,065	—	—	1,185	12,144	1,633	226	5,962	972	7,977	30,099	6,347

(*e*) For the Year ending 31st March, 1923.

District.	Balance in hand 1st April, 1922. 1	Contributions of Councils charged with Expenses. 2	Miscellaneous Receipts. 3	Total Receipts. 4	Deficit 31st Mar., 1923. 5	Deficit 1st April, 1922. 6	Salaries.		Travelling Expenses of Fishery Officers. 9	Cost of Prosecutions and Law Expenses generally. 10	Purchase, Maintenance or Hire of Vessels or Boats. 11	Stationery, Printing, Postage and Advertisements. 12	Miscellaneous Expenditure. 13	Total Expenditure. 14	Balance in hand 31st March, 1923. 15
							Clerk, &c. 7	Fishery Officers. 8							
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Cumberland	81	450	—	450		—	—	286	64	—	105	3	14	472	59
Lancashire and Western ...	371	10,027	1,299	11,326		—	125	4,796	219	76	2,599	359	3,198	11,372	325
South Wales	483	900	5	905	—	—	100	335	213	13	—	97	1	759	629
Cornwall	219	350	8	358	—	—	—	160	77	—	—	35	12	284	293
Devon	19	594	5	599		—	100	151	81	59	93	110	12	606	12
Southern	51	630	—	630	—	—	130	322	60	—	—	98	67	677	4
Sussex	85	589		589	—	—	40	338	126	—	—	35	13	552	122
Kent and Essex	100	300	—	300	—	—	120	70	7	7	—	57	20	281	119
Eastern	1,370	6,220	1,040	7,260	—	—	250	3,477	92	2	2,361	139	388	6,709	1,921
North-Eastern	3,341	1,970	87	2,057	—	—	220	1,202	453	—	—	56	229	2,160	3,238
Northumberland	222	1,000	45	1,045	—	—	100	355	170	33	47	72	54	831	436
Total	6,342	23,030	2,489	25,519		—	1,185	11,492	1,562	190	5,205	1,061	4,008	24,703	7,158

APPENDIX C.

COASTLINE BOUNDARIES OF THE AREAS OF THE RESPECTIVE DISTRICT INSPECTORS OF FISHERIES, TOGETHER WITH THE ADDRESSES OF THE MINISTRY'S LOCAL FISHERIES OFFICES.

District.	Coastline Boundaries.	Address of District Headquarters.
NORTH EASTERN	Berwick to Hartlepool (inclusive)	Trinity House, Fish Quay, North Shields **Telephone*: North Shields 161
HULL	Hartlepool (exclusive) to the Humber	49, West Dock Avenue, Hull **Telephone*: Hull Corporation 1461 Sub-Office: Park Hall, Aislaby, Sleights, R.S.O., Yorks
GRIMSBY	Humber to Hunstanton (inclusive)	174-176, Cleethorpe Road, Grimsby **Telephone*: Grimsby 2184
EASTERN	Hunstanton (exclusive) to Tilbury	Fisheries Office, Esplanade, Lowestoft **Telephone*: Lowestoft 88.
THAMES	West of line drawn from Tilbury to Gravesend	43, Parliament Street, London, S.W.1 †*Telephone*: Victoria 8700
SOUTH EASTERN	Gravesend to Lyme Regis (inclusive)	The Quay, Poole **Telephone*: Poole 97 Sub-Office: Fisheries Office, Fish Market, Ramsgate
SOUTH WESTERN	Lyme Regis (exclusive) to Avonmouth (inclusive)	Barclay's Bank Chambers, Princess Square, Plymouth **Telephone*: Plymouth 1856
SOUTH WALES	Avonmouth (exclusive) to Aberystwyth (exclusive)	Government Buildings, St. Mary's Street, Swansea **Telephone*: Swansea 4264
NORTH WALES	Aberystwyth (inclusive) to Hoylake (inclusive)	Castle Bank, Conway *Telephone*: Conway 19
NORTH WESTERN	Hoylake (exclusive) to Scottish Border	Central Chambers, North Albert Street, Fleetwood **Telephone*: Fleetwood 579

* Telegraphic Address: *Fishmin,—.*
† Telegraphic Address: *Fisheries, Parl, London.*

APPENDIX D.

SCIENTIFIC REPORTS RELATING TO FISHERIES, PUBLISHED BY THE MINISTRY DURING THE PERIOD 1919-23.

FISHERY INVESTIGATIONS.

SERIES I.—SALMON AND FRESHWATER FISHERIES AND MISCELLANEOUS.

Vol. II.		Price. s.	d.
No. 1.—*The Methods of Fish Canning in England*, by Prof. Jas. Johnstone, D.Sc.	1921	2	6

SERIES II.—SEA FISHERIES.

Vol. IV.			
No. 1.—*Report on Age Determination from Scales of Young Herring, with Special Reference to the Use of Polarised Light*, by R. E. Savage, A.R.C.Sc., D.I.C.	1919	4	6
No. 2.—*A Review of the Methods of Age and Growth Determination in Fishes by means of Scales*, by Rosa M. Lee, M.A.	1920	4	0
No. 3.—*Report on the Scales of some Teleostean Fish, with Special Reference to their Method of Growth*, by G. W. Paget, B.A. ...	1920	3	6
No. 4.—*Report on Herring Trawling*, by J. O. Borley, O.B.E., M.A., and E. S. Russell, M.A., B.Sc.	1922	7	6
No. 5.—*The Exploration of Lousy Bank*, by E. L. Pawsey, Lieut., R.N. (Retd.), G. T. Atkinson, and F. M. Davis, B.A. ...	1922	1	3
No. 6.—*The Marine Deposits of the Southern North Sea*, by J. O. Borley, O.B.E., M.A.	1923	15	0

Vol. V.			
No. 1.—*Report on the Market Measurements in Relation to the English Cod Fishery during the Years 1912-14*, by E. S. Russell, M.A., D.Sc.	1922	16	0

		Price. s.	d.
No. 2.—*The Spawning of Plaice in the Southern Part of the North Sea*, by H. J. Buchanan-Wollaston.	1923	7	6
No. 3.—*The Plaice Fishery and the War*, by J. O. Borley, O.B.E., M.A., and Collaborators ...	1923	12	0
No. 4.—*An Account of the Fishing Gear of England and Wales*, by F. M. Davis, B.A.	1923	15	0
No. 5.—*Report on Experimental Hauls with Small Trawls in Certain Inshore Waters off the East Coast of England*, by Wm. Wallace, D.Sc.	1923	6	6
No. 6.—*The Macroplankton of the Plaice Egg Cruises, 1920-1921*, by R. E. Savage, A.R.C.Sc., D.I.C.	1923	6	6
Vol. VI.			
No. 1.—*Report on Seasonal Variation in the Chemical Composition of Oysters*, by E. S. Russell, M.A., D.Sc.	1923	3	0
No. 2.—*Quantitative Studies on the Fauna of the Sea Bottom—No. 1. Preliminary Investigation of the Dogger Bank*, by F. M. Davis, B.A.	1923	6	0

Series III.—Hydrography.

		s.	d.
Vol. I.—*The Hydrography of the English Channel*, by E. C. Jee, D.Sc.			
Part I.—*Start Point to the Channel Islands*, 1904-17.	1919	10	0
Part II.—*Isle of Wight to Cap de la Hague*, 1904-18.	1919	4	0
Part III.—*Isle of Wight to Havre*, 1904-18.	1920	3	0
Part IV.—*Newhaven to Caen*, 1903-12. ...	1920	3	0
Part V.—*Plymouth to Brest*, 1907-11. ...	1920	2	6
Part VI.—*Across the Mouth of the Channel*. ...	1921	5	0
Vol. II.—*Hydrographical Observations at English Lightships*, by E. C. Jee, D.Sc.			
Part I.—*The Seven Stones Lightship*... ...	1919	4	0
Vol. III.—*Hydrography of the Atlantic Ocean*, by E. C. Jee, D.Sc.			
Part I.—*The Area centred on 50° N., 20° W*....	1919	2	6
Vol. IV.—*Hydrography of the North Sea*, by E. C. Jee, D.Sc.			
Part I.—*From the River Tyne toward the Naze of Norway*.	1920	12	0

REPORTS BY INSTITUTIONS ON RESEARCH UNDERTAKEN WITH THE ASSISTANCE OF THE MINISTRY.

Report for 1919 on the Lancashire Sea-Fisheries Laboratory. 1920.

On the Dietetic Value of Herring and other Fishes, by J. Johnstone. p. 16.

Report for 1920 on the Lancashire Sea-Fisheries Laboratory. 1921.

Plaice Measurements made in 1920, by W. Birtwistle. p. 30.

Sole Measurements in 1920, by Jas. Johnstone. p. 103.

Report for 1921 on the Lancashire Sea-Fisheries Laboratory. 1922.

The Plaice Fisheries of the Irish Sea, by Jas. Johnstone, W. Birtwistle and W. C. Smith. p. 37.

Some Diseases and Parasites of Fishes, by Jas. Johnstone. p. 222.

Report for 1922 on the Lancashire Sea-Fisheries Laboratory. 1923.

Investigations on the Cod, by Jas. Johnstone, W. C. Smith and R. A. Fleming. p. 51.

Investigations on Shoaling Herring, by W. Birtwistle and H. Mabel Lewis. p. 64.

Malignant Tumours in Fishes, by Jas. Johnstone. p. 87.

Journal of the Marine Biological Association, Vol. XII. 1922.

On the Food of Young Plaice (Pleuronectes platessa), by Andrew Scott. p. 678.

Report for 1923 on the Lancashire Sea-Fisheries Laboratory.

Introduction and Account of the Work at Piel, by Jas. Johnstone.

Plankton Investigations at Port Erin, by A. Scott.

Food of Irish Sea Herring, by A. Scott.

The Manx Herring Fishery in 1923, by W. C. Smith.

Age-Groups of Irish Sea Herrings, by W. Birtwistle and H. Mabel Lewis.

Diseases of Fishes, by Jas. Johnstone.

" Aberystwyth Studies," Jubilee Volume, 1922.

Investigations into the Fauna of the Sea Floor of Cardigan Bay, by R. Douglas Lawrie and E. Emrys Watkin.

PUBLICATIONS RELATING TO FISHERIES—*continued*.

Plaice Fisheries OF THE NORTH SEA :—

		PRICE. s.	d.
Vol. I., Special Statistics. [Cd. 4227]	1905-6	1	9
Vol. II., Do. [Cd. 4738]	1906-7 and 1907-8	4	5
Vol. III. Do. [Cd. 5362]	1905-9	1	6
Vol. IV., Biological Statistics. [Cd. 5686]	1905-6	0	9

International Council FOR THE EXPLORATION OF THE SEA :—

Reports and Correspondence, Vol. I. [Cd. 2966] ...	1906	2	2
Reports and Correspondence, Vol. II. [Cd. 3033] ...	1906	6	9
Reports and Appendices. [Cd. 3165]	1906	0	4½
Reports and Appendices. [Cd. 5032]	1907-9	1	6

North Sea Fisheries INVESTIGATION COMMITTEE. Reports (Southern Area)—Marine Biological Association :—

Vol. I., Various. [Cd. 2670]	1905	8	9
Vol. II., Part 1, Do. [Cd. 3837]	1907	5	1
... Part 2, Do. [Cd. 4641]	1909	8	9
Vol. III., Do. [Cd. 5546]	1911	5	10
Vol. IV., Plaice Marking, Transplantation, &c. [Cd. 6125]	1912	13	0

Fishery Investigations :—

Reports of Fishery Investigations conducted by the Ministry have, since 1913, been issued in three series, viz. :—

Series I.—Freshwater Fisheries and Miscellaneous.
Series II.—Sea Fisheries.
Series III.—Hydrography.

A detailed list of the numbers already published may be had on application to the Fisheries Secretary, Ministry of Agriculture and Fisheries, 43, Parliament Street, S.W.1. For a list of recent reports see Appendix D of this Report.

Reports of Committees :—

Report of the Committee appointed to consider applications of the Devon and Cornwall Local Fisheries Committees for grants from the Development Fund for assisting fishermen to instal Motor Power in their Boats and for other purposes. [Cd. 6752]	1913	0	5½
First Report of the Advisory Committee on Fishery Research. [Cd. 7200]	1913	0	2½
Departmental Committee on Inshore Fisheries:			
Vol. I.—Report and Appendices. [Cd. 7373] ...	1914	0	8½
Vol. II.—Minutes of Evidence and Index. [Cd. 7374]	1914	2	10
Rivers Pollution and Fisheries: First Non-technical Report of the Standing Committee on Rivers Pollution ...	1924	0	3

THE ABOVE GOVERNMENT PUBLICATIONS can be obtained in the manner shown on p. 1 of this wrapper, except as otherwise stated.

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